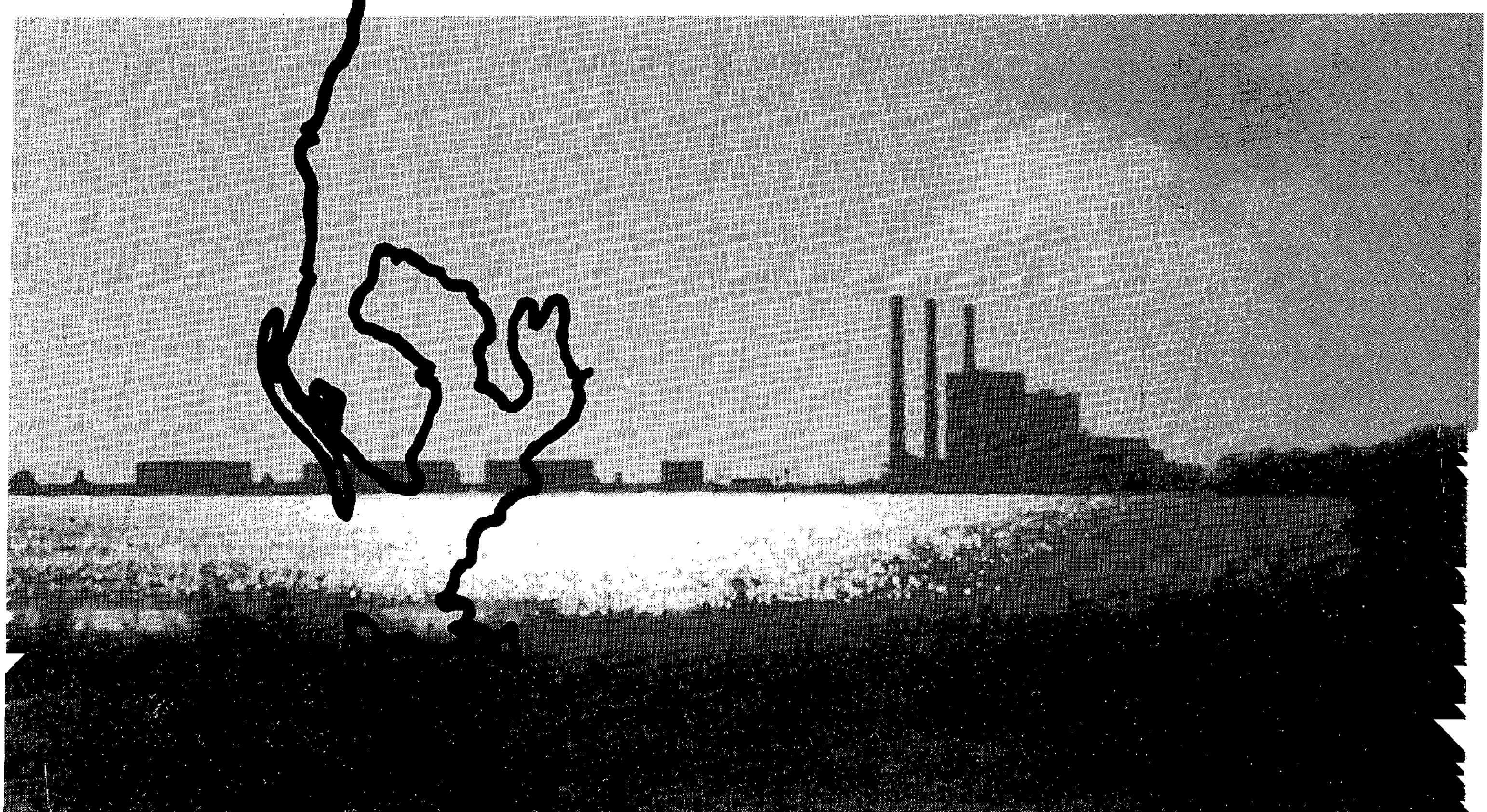
Coal Conversion Impact Study for the Tampa Bay Region



tampa bay
regional
planning
council

TAMPA BAY REGIONAL PLANNING COUNCIL

Councilwoman Saundra Rahn, Chairman	City of Bradenton
* Mr. Joe McFarland, Vice-Chairman	Hillsborough County
Commissioner Gabe Cazares, Secretary/Treasurer	Pinellas County
* Mr. Conrad Banspach, Jr.	Pinellas County
Vice-Mayor James Berfield	City of Clearwater
* Mr. Alexander S. Byrne	Hillsborough County
* Mr. Joe Chillura, Jr.	Hillsborough County
Vice-Mayor Helen L. Ercius	City of St. Petersburg Beach
Commissioner Westwood Fletcher, Jr.	Manatee County
Mayor Sandy J. Francisco	City of Oldsmar
* Ms. Beth Frierson	Pinellas County
Mayor George Henry	New Port Richey
Mayor Robert E. Hunt	City of Palmetto
Councilman John M. King	City of Temple Terrace
* Reverend Preston Leonard	Pinellas County
Commissioner Dean G. Mason	City of Sarasota
Mayor George McGough, Chairman	City of Largo
* Mr. Philip Mishkin	Pasco County
Commissioner Jan Platt	Hillsborough County
Councilman George Prigun	City of Gulfport
Commissioner Lawrence Puckett	City of Dade City
Commissioner Charles Roberts	City of Tarpon Springs
* Mr. Robert W. Saunders, Sr.	Hillsborough County
* Ms. Judith Sedgeman	Manatee County
Commissioner Donald Shaffer	City of Dunedin
Councilman Dean Staples	City of St. Petersburg
Councilman Thomas W. Vann	City of Tampa
Councilman William D. Vannatta	City of Pinellas Park
Commissioner Sandra Lee Werner	Pasco County
* Mr. Michael Zagorac, Jr.	Pinellas County

* Gubernatorial Appointees

COAL CONVERSION IMPACT STUDY

FOR THE

TAMPA BAY REGION

Prepared by
Tampa Bay Regional Planning Council
9455 Koger Boulevard
St. Petersburg, Florida

September, 1984

The preparation of this appendix was funded by grant number 83-CE-21-08-00-21-005 from the Office of Ocean and Coastal Resource Management National Oceanic and Atmospheric Administration and administered by the Florida Department of Community Affairs, Division of Local Resource Management, under the Coastal Zone Management Act of 1972, as amended.

TABLE OF CONTENTS

TABLE OF EXHIBITS

LIST OF TABLES

LIST OF TABLES (Continued)

CHAPTER ONE

BACKGROUND AND SUMMARY

As a result of federal legislation and fuel costs, electric utilities have considered the viability of conversion of existing residual oil-fired generation stations, plus the phased construction of new plants. Coal, unlike oil, is in great abundance domestically thus abating many foreign policy and national security concerns which have become more pronounced since the 1973-74 arab oil embargo. Additionally, domestic coal carries a lower price tag than dwindling domestic or more expensive foreign petroleum.

While these concerns are important to consider in selecting the fuel choice, coal is fraught with many other problems. Historically, mine safety and land reclamation were major problems. Later, unit costs were higher than oil and deleterious air quality impacts were deemed to be more severe. More recently, sulfur emissions have been found to be a principle component in acid rain. However beyond these constraints, the environmental and systematic impacts of coal transport and storage must also be considered by those economic and regulatory decision makers prior to the time of boiler retrofit or new facility site selection. Since the time of the earlier Ford Foundation coal studies, it has been discussed that deficiencies and inadequacies in the national transportation system could prove to be a major obstacle in the widespread conversion of oil to coal (Gordon,1978). Further, increased transport activity by rail could lead to greater amounts of fugitive dust emissions, increased noise and vibration. Finally, centralized storage of millions of tons of coal at a single site could also produce negative environmental consequences. Adjacent and downstream surface water could receive large amounts of trace metals and other contaminants. Leaching of impurities into groundwater sources is a distinct possibility. Fugitive dust, noise, and vibration caused by intra-site transfer is another likely problem.

With funding received through the Florida Department of Community Affairs from the Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, United States Department of Commerce, the Tampa Bay Regional Planning Council (TBRPC) is studying the possible effects of coal transport and storage within Hillsborough, Manatee and Pasco and Pinellas Counties. TBRPC and its Regional Coal Study Advisory Committee (RCSAC) have proposed a series of policies which should be considered by applicants and regulating agencies alike.

The Coal Conversion Impact Study (CCIS) of the Tampa Bay Region is a two-part study designed (1) to evaluate the potential impact engendered by the increased consumption of coal as a steam producing fuel used to generate electrical power to the regional surface transportation network, and (2) to increase public awareness of the reasons for conversion from oil to coal and the probable effects of this procedure.

The CCIS has recommended policies which could be incorporated into review of applications for new stations or the retro-fit of existing stations. The policies are concentrated into the transportation and storage of coal issue areas. Finally the CCIS has recommended that Chapter 403 of the Florida Statutes be amended to reflect the need to determine the possibility of deleterious transportation impacts caused by the increased use of coal.

CHAPTER TWO

CURRENT AND FUTURE DEMAND

2.1 PETROLEUM AND FOSSIL FUEL MIX

Florida, which is one of the fastest growing states in the nation, is also one of the greatest consumers of energy, especially in the form of petroleum products. The availability of petroleum products is an extremely active agent in the vitality of the state's economy. The robustness of the state's three leading economic sectors: tourism, construction, and agriculture is directly linked to fuel availability. To be certain, other factors or ingredients contribute to the success of these three areas in driving the state's and, ultimately, the local economy.

Per capita energy consumption in Florida does vary somewhat from other states in the nation. As can be seen by reviewing Figures 2.1A and 2.1B energy consumption in Florida appears to rely heavily upon petroleum as witnessed by the comparison of energy consumption by sector. This is especially apparent in the transportation sector in the use of petroleum in which Florida (1.7 Quadrillion (Q) BTU) ranked fourth behind Texas (3.4 Q BTU), California (3.2 Q BTU), and New York (2.0 Q BTU), (GEO, 1983). Transportation use amounted to practically two-thirds of all petroleum products consumption (see Figure 2.1.C).

Florida, like most states in the nation, is a net importer of fossil fuels such as petroleum products. The state's production of known sources of petroleum and natural gas peaked in 1978 with 47.5 million barrels and 51.6 million-thousand cubic feet (GEO, 1983). While this supply was never sufficient, it did reduce the state's demand on outside resources.

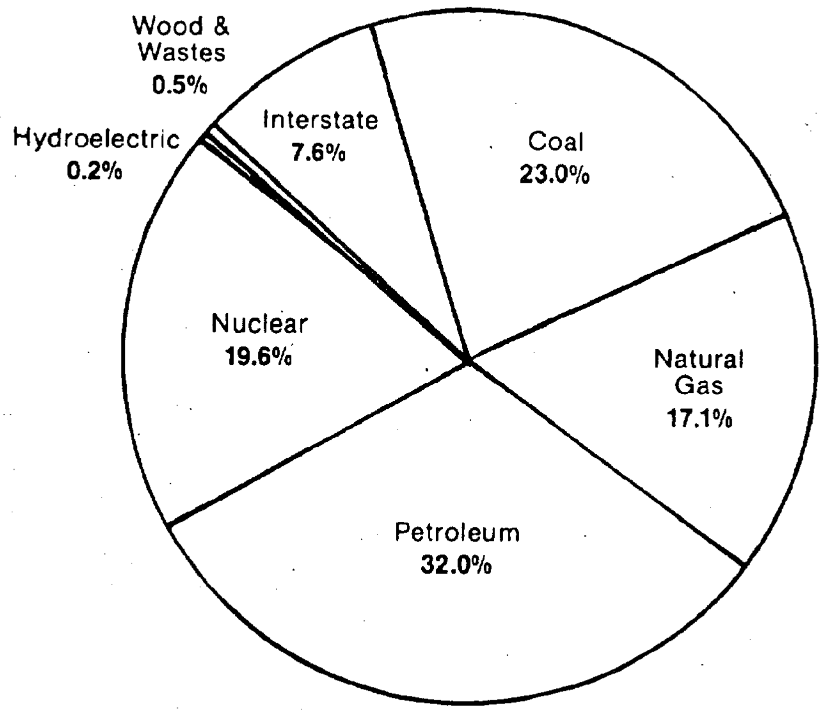
Reliance upon outside resources is a continuing problem for the state as well as the nation. The disruption of foreign oil as a result of the embargo in 1973-74 sent a rippling effect throughout the nation, and Florida's economy was not immune to this malady. Florida's industries suffered production cut backs and worker lay-offs, as did virtually all of other states.

Two of Florida's leading industries, tourism and construction, are extremely elastic, that is, their prosperity is dependent upon the health of other industries in the economy. Therefore when the national economy slumps, these industries will contract also. When this occurs other sectors of the state economy also faulter thus leading to a general economic malaise in the state.

Out of the disruption of the embargo came a general understanding of the limit of the supply of petroleum as the energy basis for an industrialized economy. Other energy sources would have to be exploited with renewed vigor. A further realization grew which acknowledged that no single solution could bridge the projected energy gap. Continued reliance on oil and natural gas has environmental, defense and foreign policy implications. Solar technology solutions still are not cost-effective, although greater public demand for results in this area are evident in both new architectural and construction techniques which incorporate passive solar

FIGURE 2.1.A

Florida Energy Consumption by Fuel Type
1970-1982
(trillion BTU)



Consumption by Electric Utilities, 1982
Florida
100% = 107.6 trillion Btu

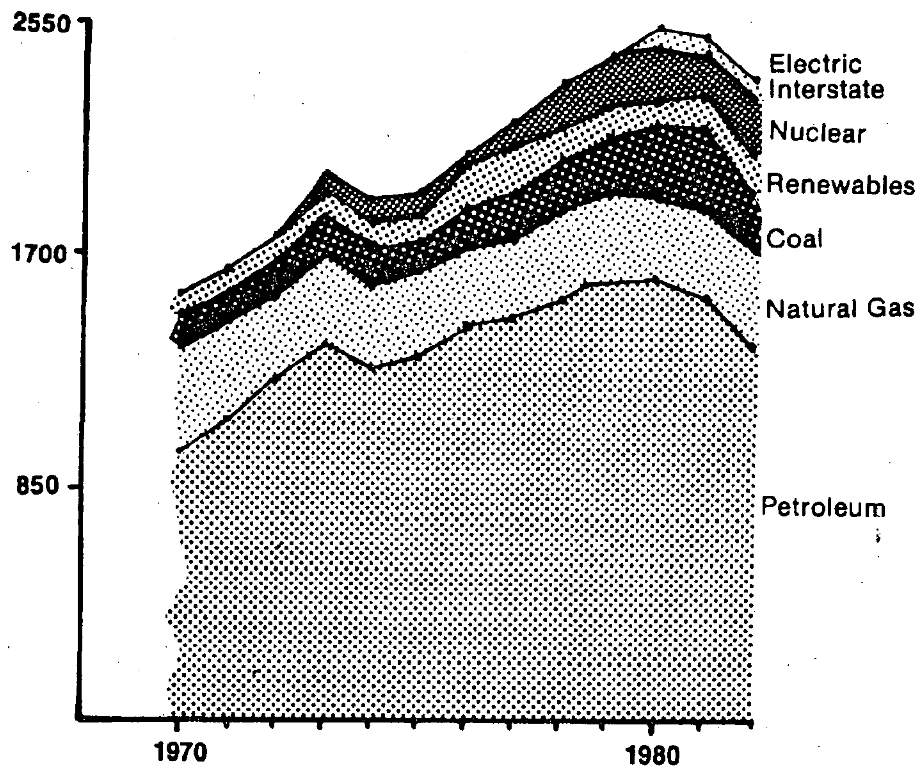
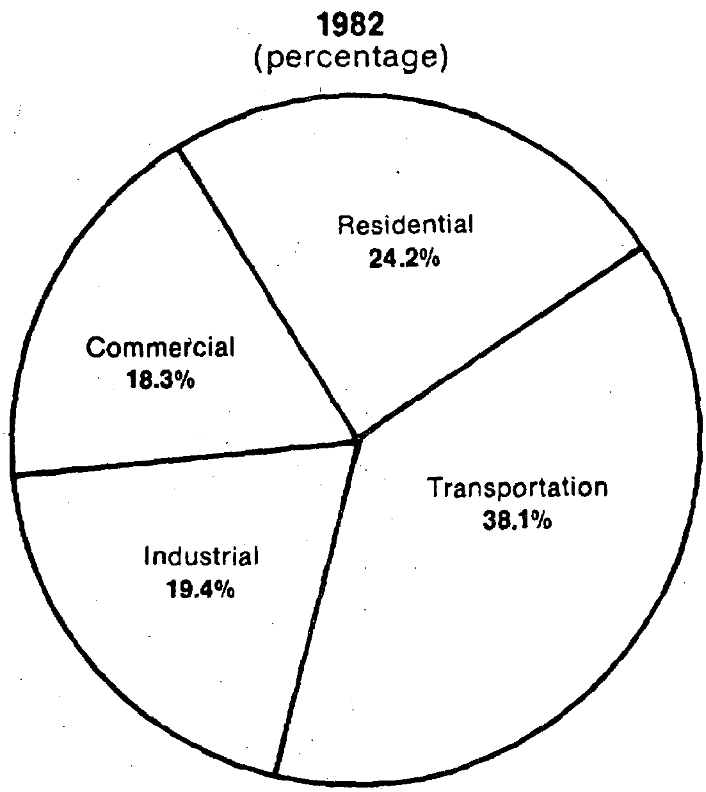
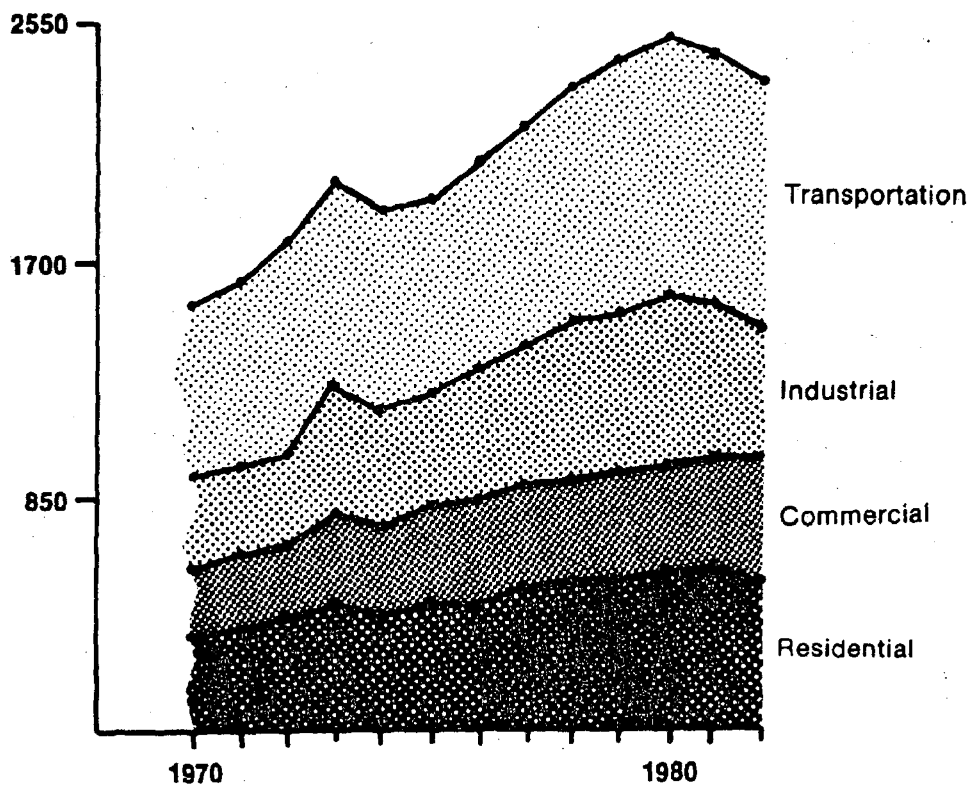


FIGURE 2.1.A-1

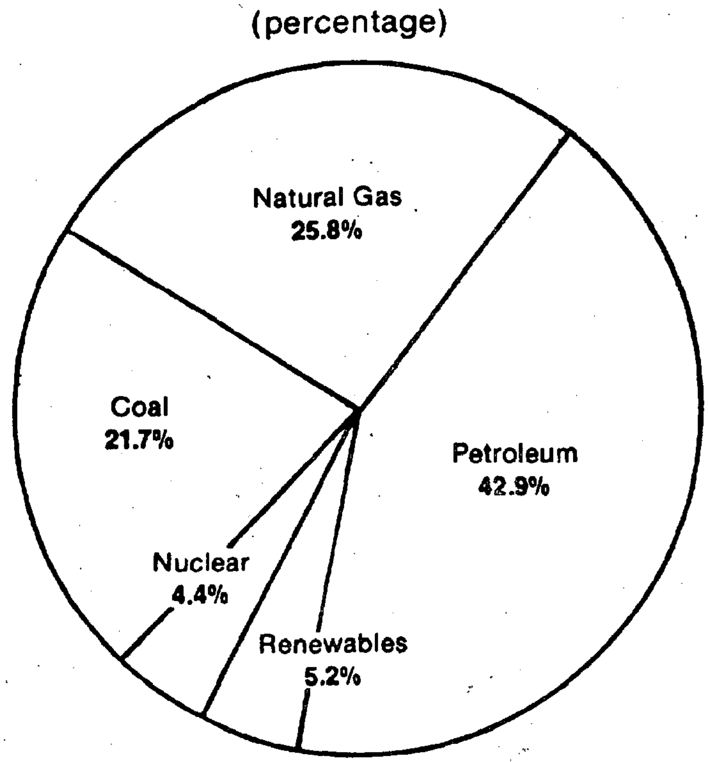
Energy Consumption by Sector
FLORIDA



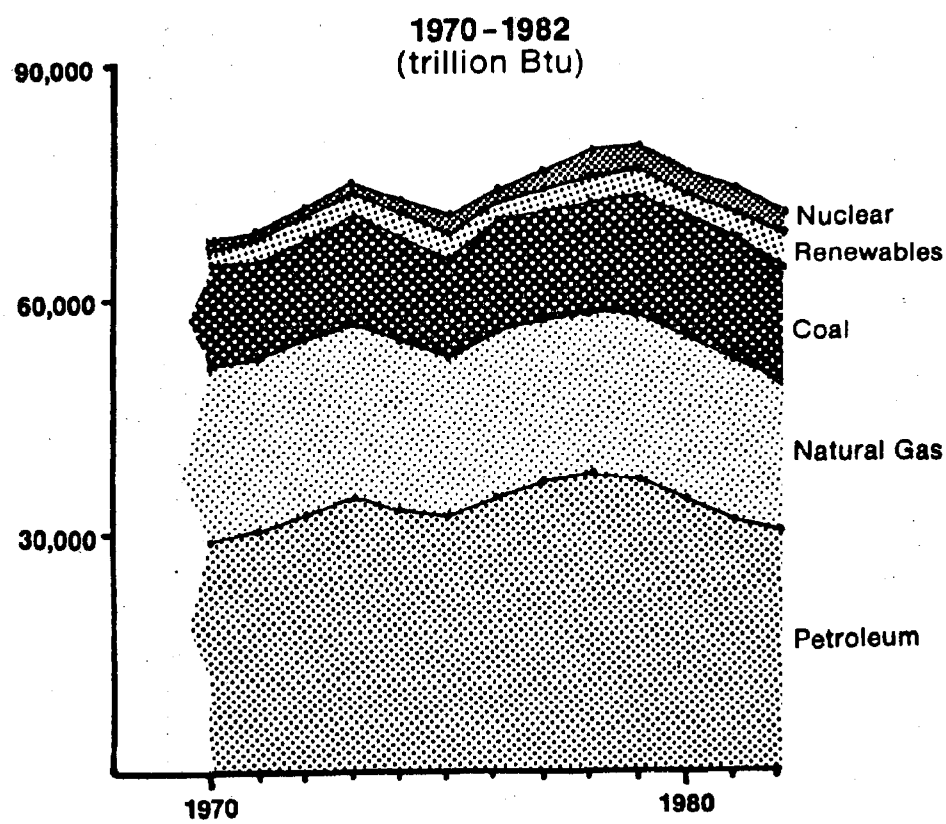


Source: Governor's Energy Office

FIGURE 2.1.B
Sources of Energy and Yield
United States, 1982



Source: U.S. Department of Energy



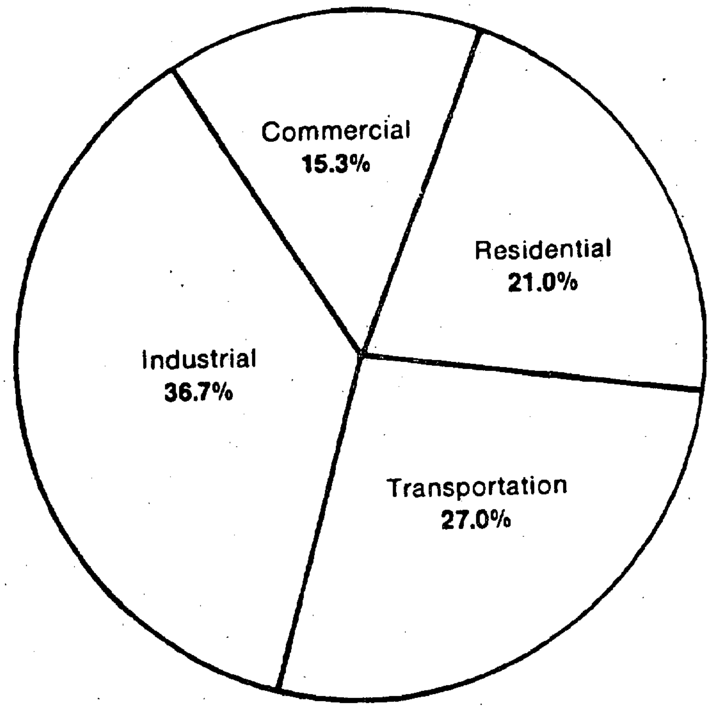
Source: U.S. Department of Energy

FIGURE 2.1.B-1

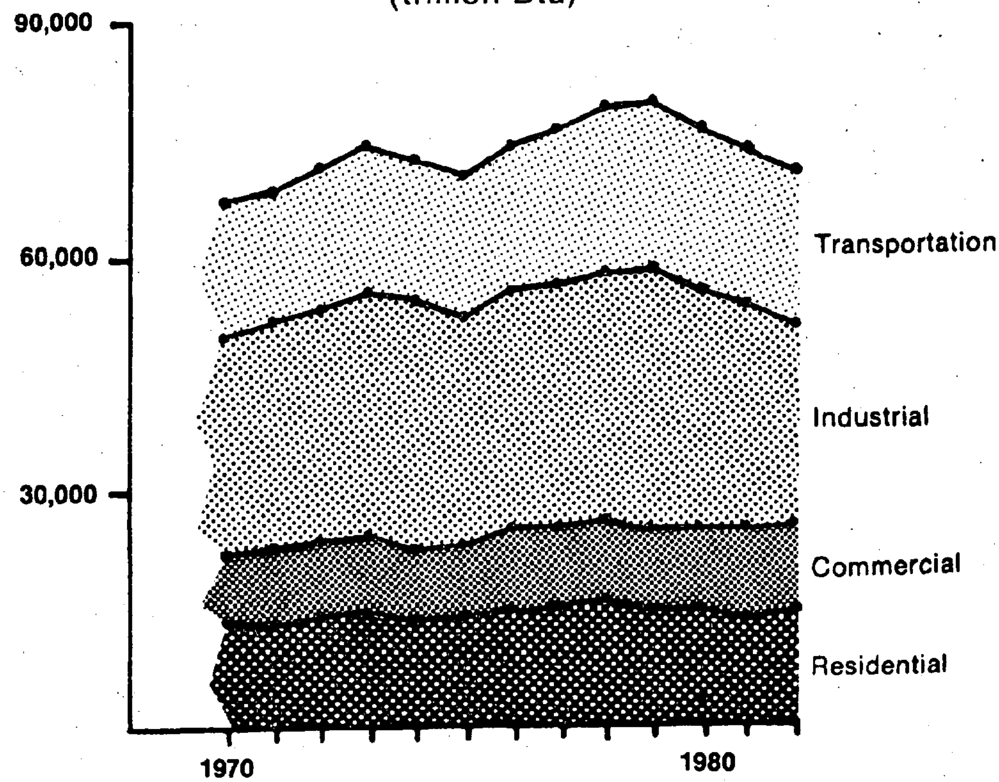
Energy Consumption by Sector

UNITED STATES

1982
(percentage)



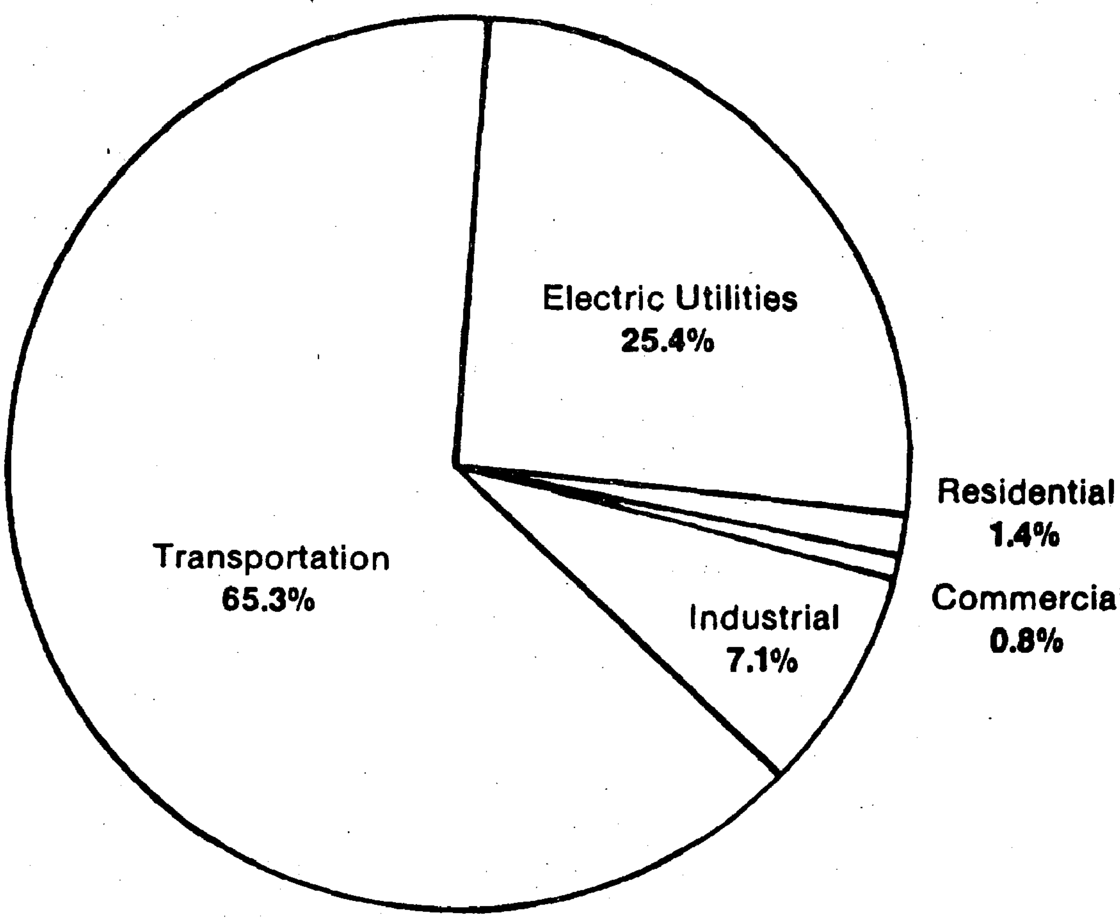
1970-1982
(trillion Btu)



Source: U.S. Department of Energy

FIGURE 2.1.C

Petroleum Consumption by Sector, 1982
Florida
100% = 1356.1 trillion Btu



Source: Governor's Energy Office

considerations and in renewed interest in solar water heating fixtures. Use of the latter appliances may reduce residential unit demand for energy by as much as 30 percent.

2.2 ALTERNATE FUEL SOURCES

Other fuel substitutes for petroleum products are also being considered by the utility industry. Nuclear power and coal are the leading contenders. Nuclear fuels use by the utility industry has established a record of public controversy centered around cost, environmental and safety concerns. Two of the largest public utility companies in the state, Florida Power and Light Company (FP&L) and Florida Power Corporation (FPC) own and operate nuclear power plants in Florida. In 1982, 19.6 percent of all electricity generated in the state was produced by steam boilers powered by nuclear reaction (GEO, 1983) (see Figure 2.3A). This amounted to 210.7 Trillion BTU) (British Thermal Units) or 19,319 gigawatt-hours. As far as the state's total energy consumption is concerned nuclear power was responsible for the creation of a 9 percent of the entire energy "pie", practically twice the national average.

Conservation, which although not an actual source of energy, can be combined with existing sources and technologies to help prolong their usefulness until new technologies can be perfected and their unit costs reduced. Such established programs as residential insulation, energy audit and window treatment, street light conservation, conservation water heating, time-of-use rates, energy efficiency appliance ratings, industrial/commercial energy audits, public information, and the State Residential Building Energy Code have all combined to reduce energy demands for those who have participated. However, government and utility officials all concur with the fact that conservation, alone, can not replace the demand for increased electrical capacity in the form of new generating units and more fuel sources.

While it is certain that conservation and nuclear energy will reduce the State's dependence on petroleum products as the source of combustion which eventually leads to electrical energy, the state's explosive growth coupled with technological shift will probably keep pace with the reduced demand, based on conservation, causing a net increased demand due to new or increased accounts. This can be witnessed by reviewing firm peak demand estimates in two ten year site plans (TYSP) prepared by the same utility for the same period (FY 1984-85).

TABLE 2.2A

FIRM PEAK DEMAND MW(3)

	1983 TYSP	1984 TYSP
FY 84-85	5358	4847

Source: Florida Power Corporation, _Ten Year Site Plan_, December, 1982 and December, 1983

Yet, with 150 persons moving into the Tampa Bay area daily, as well as the construction boom in commercial and industrial properties, new demand may well out strip the impact of conservation. Currently under review by the Tampa Bay Regional Planning Council are twenty-one significant projects which are located in the four county area of Pasco, Pinellas, Hillsborough, and Manatee and are deemed by the Florida Department of Community Affairs to be developments of regional impact. Combined, these projects at a projected build-out in the year 2000, have an estimated average daily demand for 3,615,000 KW and a peak hour demand of approximately 300,000 KWH. This is in excess of the utilities' projected capacities. It should also be stated that, historically, developments of regional impact comprise less than 25 percent of all development activity in the Tampa Bay area (TBRPC, 1984).

Thus, it is apparent that this area faces increasing demand for electrical energy plus a more uncertain future concerning petroleum and natural gas availability, and the realization that other sources, including conservation may not be able to satisfy the increasing demand. Therefore, another source of steam generation is being considered. That source is coal.

2.3 CURRENT DEMAND FOR COAL IN FLORIDA

While coal is used in industrial as well as electrical utility boilers around the world, its use in Florida is very limited in the former category to approximately two percent of the total consumed, based on information from the Governor's Energy Office (GEO, 1983). Currently, coal consumption amounts to approximately 10.8 percent of the state's total which is considerably less than the total consumed by the nation (21.7%) (See Figures 2.1.A and 2.1.B). That 10.8 percent of the total energy source pie does produce approximately 23 percent, or about 248 trillion BTUs of all electricity produced in the state was the result of the steam created by coal combustion (see Figure 2.3.A, GEO 1983).

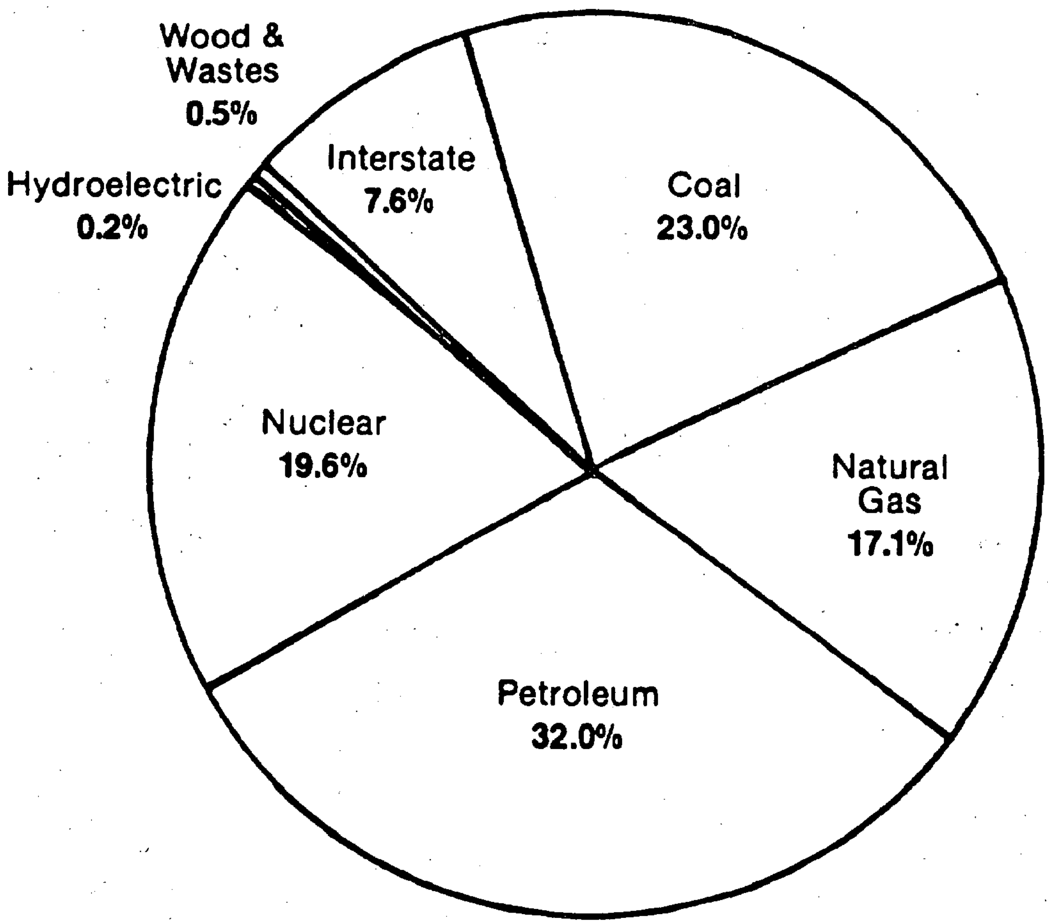
At the national level, the U.S. Department of Energy (DOE) is analyzing the conversion of several electric generation plants in the state from oil to coal use. Under the initial study requested by the Florida Public Service Commission, the DOE is assessing the impacts of conversion of 14 plants consisting of 27 generating units. The purpose of the conversion assessment is to minimize oil consumption in as many of the candidate units as possible. Of the 14 candidate plants, three plants are located in the Tampa Bay area (see Figure 2.3.B).

The DOE reviewed each of the candidate plants using engineering, environmental, and economic criteria. Under engineering concerns the Economic Regulatory Administration (ERA) considered:

Boiler design/derating
Space availability
Boiler size and age
Availability of transportation/handling facilities
Conversion costs

FIGURE 2.3.A

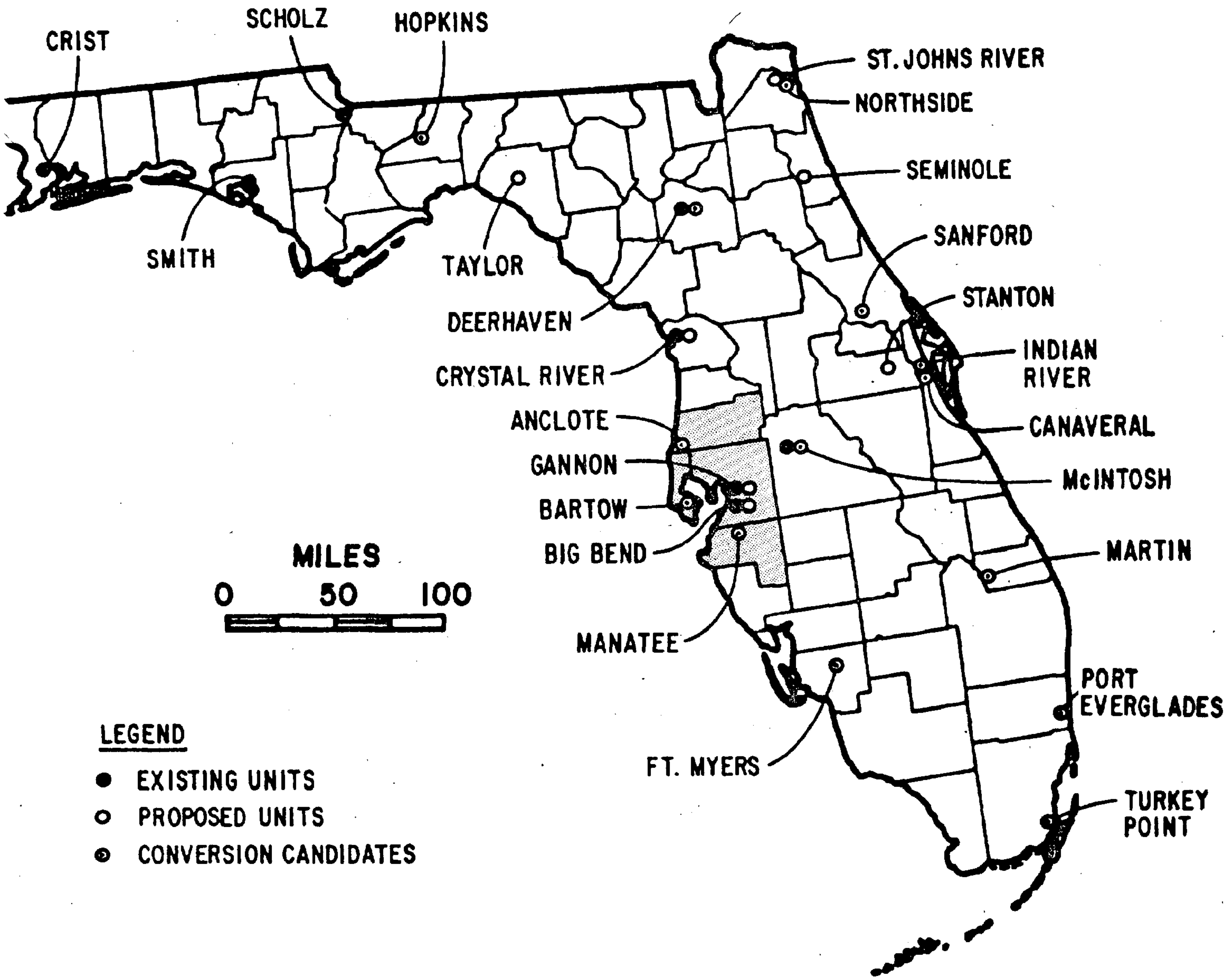
Consumption by Electric Utilities, 1982
Florida
100% = 1076.6 trillion Btu



Source: Governor's Energy Office

FIGURE 2.3.B

Locations of Existing, Proposed, and Conversion-Candidate Coal Fired Powerplants Florida and the Tampa Bay Region



Source: Economic Regulatory Administration, U.S. Department of Energy
Tampa Bay Regional Planning Council

Secondly, the ERA study was concerned with the conversion candidates impacts on:

Air quality
Surface water quality
Ground water quality
Solid waste disposition

Finally, the ERA considered the economic feasibility based on the results of several inputs; among them were:

Capital costs
Operation and maintenance costs
Boiler deratings
Fuel prices (Mine mouth and transport)
Rate base

Based on the dynamics of these items, the ERA established a rating for each of the 14 plants to determine the logic for further conversion feasibility analysis. The following table indicates the results of ERA's analysis.

TABLE 2.3.A

COMPOSITE RATING

	Engineering	Environment	Economic	Composite
Anclote *	P	G	P	F
Bartow *	G	F	F	F
Cape Canaveral	G	F	F	G
Deerhaven	G	G	G	G
Fort Myers	G	G	P	F
Hopkins	F	G	G	G
Indian River	F	G	F	F
Manatee *	G	G	G	G
Martin	G	G	P	F
McIntosh	F	F	F	F
Northside	F	F	G	F
Port Everglades	G	F	F	F
Sanford	G	G	F	G
Turkey Point	G	F	F	F

Source: Economic Regulatory Administration, U.S. Department of Energy
Note: G = Good
F = Fair
P = Poor
* = Located in the Tampa Bay area

Five stations were deemed overall good conversions: Cape Canaveral, Deerhaven, Hopkins, Manatee, and Sanford. Nine were considered fair conversions: Anclote, Bartow, Fort Myers, Indian River, Martin, McIntosh, Northside, Port Everglades, and Turkey Point. No stations were determined overall to be poor conversions.

Why is coal being considered as an alternative fuel source for petroleum products? In the most general of considerations, coal is found in great abundance in the United States and throughout the Western Hemisphere. It has been estimated that of the total world resource of 300,000 quadrillion BTU (Quads) approximately 27 percent or 80,000 Quads is located with the United States (National Academy of Sciences, 1980).

2.4 CONSTRAINTS TO COAL USE AND CONVERSION

It must be noted that consideration of coal as a source of steam for the production of electrical energy is not without concern for environmental, economic, and transportation impacts caused by this selection.

Of ever-increasing concern in both regulatory and industry circles is the extent of sulfur emissions resulting from coal combustion. The sulfur released from coal combustion in the form of sulfur oxides (SOX) combined with hydrogen compounds to form acid rain. In some areas in the northeast and north central United States, the pH value of surface waters has been indicated at 4.0 on the scale which establishes water at 7.0 and acid compounds below that value. Acid rainfall in these areas limit the continuance of flora and fauna thus creating imbalances in regional food chains.

Other residuals commonly found in the flue gases consist of nitrogen oxides, carbon monoxide, carbon dioxide, organic compounds, particulates, and even trace metals such as cadmium, chlorine, and selenium. (OCED, 1983). Still other environmental and logistical problems exist concerning the disposition of fly ash and bottom ash, plus sludge from flue gas desulfurization (FGD) systems (OCED, 1983).

In addition to the relationship of sulfur content to air quality other concerns such as source, or seam, location and BTU potential must also be considered. Traditionally, eastern United States coal has been mined below the surface. In addition to the cost of subterrenean mining, there are short-term, as well as long-term miner safety concerns. Eastern coal is generally characterized by higher sulfur content but also lower BTU output potential. Since the established market for coal has been the northeast and northcentral industrialized regions of the United States, barge and/or rail transport was not a major concern as these areas are well served by river, canal and rail networks.

Western coal has been more easily, thus less expensively, mined as the seam lies closer to the surface, allowing for less costly retrieval methods. However, western coal generally has a lower sulfur content thus posing a more limited environmental threat without air pollution abatement equipment such as FGD systems and electro static precipitators (ESP). However, increased transport costs must be added to the initial lower price, thus causing western coal to lose its attractiveness based on lower mine mouth costs.

Due to the passage of the Power plant and Industrial Fuel Use Act of 1978 (PIFUA '78), the Energy Supply and the Environmental Coordination Act of 1974 (ESECA) and the Clean Air Act of 1970 (CAA), environmental constraints and air quality standards have been adopted which will require all new large coal-fired units to install desulfurization equipment. This equipment will raise the cost of burning coal and thus reduce the economic advantage of western coal. (National Academy of Sciences, 1980). It should be further noted that scrubbers and other control equipment will reduce coal-to-electricity efficiencies to approximately 38 percent (National Academy of Sciences, 1980). Therefore, still greater quantities of coal will have to be transported to maintain the appropriate levels of output from the plants.

Power plant owners are compelled to consider not only the costs to abate potential environmental degradation, but also rising fuel costs, transportation costs, and other operations and maintenance expenses. New construction of a coal-fired plant without FGD, with FGD, and with FGD and additional pollution controls (such as ESP) can average $1090, $1270, and $1420 per kilowatt installed, respectively (OCED, 1983). It should be noted that Florida Power Corporation has conducted research which indicates that construction expenses for a 700 MW power station can average $1035 per kilowatt installed in the southeastern United States. Transportation expenses amount to approximately 20 percent of the total fuel cost. Based on information from the GEO, the 1982 unit price (per ton) for coal paid by utility companies in Florida was $51.82; this constitutes an increase of 539 percent in the 1972-1982 decade. For the same time frame, the utility companies paid $0.65 per gallon of residual fuel which amounted to an 866 percent increase. However such a comparison without considering a million BTU equivalency is somewhat distorted. When the adjustment is made to equate the fuels by BTU output, the results are as indicated in Table 2.4.A.

TABLE 2.4.A

PRICE OF FUEL PER MILLION BTU

COAL		RESIDUAL FUEL	
Year	Amount	Year	Amount
1972	$0.4248	1972	$0.4189
1974	0.7061	1974	1.7743
1982	2.1815	1982	4.3249

PERCENT INCREASE PER MILLION BTU 1972-1982

Coal	Residual Fuel
514 %	1032 %

Source: Govenor's Energy Office, 1983

Since this study is predominately concerned with potential surface transportation system impacts caused by the increased demand for steam coal, these impacts will be addressed in a brief form in this section. Due to the distance between the coal supply at its seam and its demand at the electric generating plants, coal must be moved by the most economical means while observing safety and other precautions. Based on the location of the bulk cargo's final destination, coal may be trans-shipped once, or even several times. Each trans-shipment greatly increases time, expense, and hastens other logistical and scheduling problems. Depending upon the location and the change in mode barge to rail, rail-to-rail or river barge to ocean-going barge, the cost of each trans-shipment can vary between \$1.50 to \$4.00 per ton (Vitale and McEvoy, 1981).

Each mode of transport has limitations. Truck transport, for instance, costs approximately five times more per ton-mile/dollar than in-land water transport and two-and-one-half times more than rail, however the outlay for infrastructure is usually minimal since the highway system is in place, whereas channels and docks, or railways and sidings would normally have to be developed. None of these thoughts consider capital outlay for trucks, barges, tugs, hopper cars and engines (Eastman, 1982). A brief review of Table 2.4.B indicates that far greater productivity is achieved using water transport than either rail or truck modes, when the choices are analyzed based on Ton/Miles/Dollar.

TABLE 2.4.B

AGGREGATE CAPITAL PRODUCTIVITY FOR WATER, RAIL, AND TRUCK: 1955-1979

	Property and Equipment			Total Assets		
	Ton-Miles per Dollar			Ton-Miles per Dollar		
Year	Water	Rail	Truck	Water	Rail	Truck
1955	83.0	55.1	48.6	86.3	21.2	48.4
1960	73.0	43.8	25.8	79.7	19.3	27.6
1965	80.5	48.8	23.3	81.6	23.0	23.1
1970	130.2	46.2	17.1	144.4	23.0	15.5
1975	91.1	41.8	21.1	87.5	20.1	10.3
1976	99.1	44.7	21.8	88.1	22.2	10.5
1977	85.9	43.5	21.7	76.2	21.7	10.4
1978	85.7	44.2	20.7	74.6	22.3	9.95
1979	86.4	44.0	17.6	65.9	22.0	8.78

Source: Interstate Commerce Commission Transport Statistics in the United States, appropriate years Eastman, S.E. "Selected Productivity Comparisons in Surface Freight Transportation", Transportation Research Record Nr. 880

Based on analysis performed by the National Academy of Sciences, it has been found that approximately half (by weight) of the coal is transported by rail. Approximately 25 percent moves at least a portion of the journey by barge, while trucks move nearly 15 percent. The balance has several trans-shipments and, thus, is difficult to assign to any particular mode.

All of the previous modes transport coal in a dry bulk state. However, coal can be transported in a fluidized form by first pulverzing the solid and adding it to a liquid transport media such as water (with an additive) or residual fuel (in a 50-50 mixture). It can then be transported in its liquid state for a distance of 300 to 400 miles (National Academy of Sciences, 1980).

Currently, there is an existing coal slurry line called the Black Mesa Pipeline which originates at a mine site in the Navajo-Hopi Indian Reservation in Arizona and spans a distance of 273 miles to the Mojave Power Plant in Nevada. The system is operated by nine pumps in four pumping stations which generate 9,600 kw. The system can deliver approximately 5.0 million tons per annum through its 18 inch diameter pipe (Zandi and Gimm, 1976). Over a fairly flat terrain, one metric ton can be moved one kilometer (approximately .62 miles) per kilowatt hour (Condolios, 1966).

Even though there are some obvious benefits to coal slurry use, there still exist legal and, potentially, environmental barriers to industry-wide use of this mode. Currently there is an ensuing legal battle over the development of the Transgulf Pipeline which could serve coal-fired plants in Central Florida. Secondly, there are environmental concerns about the disposition of the slurry residue which would result from a coal-water mixture. The residue would contain trace metals and other polluting agents and could be highly deleterious to surface or ground water if the disposal of the residue was not properly managed.

Therefore, the utility companies, both nationwide and within the state, must balance rising demands for electrical energy, consider dwindling residual fuel availability, public legislation which prohibits new construction of oil-fired plants, assume some savings of energy through conservation programs, and finally decide on a strategy of new coal or nuclear plant construction, or where favorable economies are achievable, a retrofit of existing oil-fired units, or some mixture of the above. It is this degree of uncertainty about demand projection, future residual fuel availability, relationship among future fuel costs, ability (and costs necessary) to overcome transportation and environmental constraints, and popular acceptance of nuclear or coal as an alternative fuel source for electricity generation that establishes the matrix in which decisions for future operations and capital policy directions which must be implemented by the utilities industry.

2.5 COAL DEMAND IN TAMPA BAY AREA

In an area which is experiencing the explosive growth of 150 new residents daily, new residential development, alone, generates a new average daily demand of 1500 KWH. Equally significant to the demand for electricity is the return of a healthy building industry. Residential, industrial and commercial development is progressing at an invigorating pace. Major office and industrial park development is being experienced in three counties of the region and large scale residential projects are being constructed throughout the region. Commercial projects which support the growth of other land uses are being developed in all of the four counties which comprise the Tampa Bay Region. All of these aforementioned projects require climatization, lighting, automation of work place equipment, etc.

Urbanization has led to a greater public demand for street lighting in existing developed areas as well as new locations. The introduction of more energy efficient units such as low pressure sodium and haldide lamps have dampended the demand for energy to satisfy this requirement, also retrofitting of existing mercury vapor units with more efficient lamps will serve to limit the extent of the demand.

Personal income in the four county region grew by an average of 13 percent in the last decade (Florida Statistical Abstract, 1983). Increases in personal income are very highly correlated with additional demand for electrical energy due to an increased demand for sophisticated consumer goods as well as labor saving devices. Often accompanying personal income increases is more leisure time, and increased leisure time has been recognized as a component of greater demand for electrical energy.

As stated earlier, the overwhelming use for coal in the state is for the production of steam which is used to generate electricity. Approximately two percent of all coal consumed in the State of Florida is used by the industrial sector. Thus, in 1982, two percent of 455.3 Trillion BTUs or 9.1 Trillion BTUs was the result of coal combustion. Based on an average yield of 12000 BTUs per pound, the industrial consumption of coal amounts to 38.0 Thousand Short Tons per annum (GEO, 1983).

The major, and practically sole, consumer of coal in Florida is the public utilities industry, which uses steam coal in the process of electric generation. In 1982, approximately 247.7 trillion BTU of coal usage can be attributed to the utility industry, or based on the previous methodology 10,321 Thousand Short Tons (GEO, 1983).

Within the Tampa Bay area there is practically no use of coal other than in the generation of electricity. Of 18 generating units owned and operated by the Tampa Electric Company (TECO), six units are coal fired; of these stations three units are located at Big Bend and the other three units are located at Gannon Station, which has three additional oil-fired units which will be converted to oil between July 1984 and August 1985. (TECO, 1983). Based on a review of the most recent Ten Year Site Plan (TYSP) (January 1984-December 1984) TECO's demand for coal will increase by approximately 33.5 percent during the next decade. This amounts to an increase from the existing 4488 Thousand Short Tons (TST) to 5993 TST by 1993 (see Table 2.5.A). Based on an average of percent increase per annum (2.23%/pa) a projection of coal demand for the year 2000 was calculated which indicates a projected demand of 6,995 TST per annum.

TABLE 2.5.A

TAMPA ELECTRIC COMPANY COAL DEMAND BY YEAR
EXISTING (a), ESTIMATED (b), PROJECTED (c)

Year	Amount
1982	4,179 (a)
1983	4,488 (a)
1984	4,848 (b)
1985	5,665 (b)
1986	5,849 (b)
1987	5,756 (b)
1988	5,563 (b)
1989	5,579 (b)
1990	5,611 (b)
1991	5,654 (b)
1992	5,872 (b)
1993	5,993 (b)
1994	6,127 (c)
1995	6,264 (c)
1996	6,404 (c)
1997	6,547 (c)
1998	6,693 (c)
1999	6,842 (c)
2000	6,995 (c)

Note: a - TECO, TYSP, existing
b - TECO, TYSP, estimate
c - TBRPC, projection

All amounts indicated in Thousand Short Tons

Source: Tampa Electric Company, <u>Ten Year Site Plan for Electrical Generating Facilities and Associated Transmission Lines, January 1984 to December 1993</u>, April 1984.

The Tampa Bay area is served by 40 generating units (including 16 peaking units) which are incorporated into seven stations. Combined, these 40 units can generate approximately 7106.0 MW based on computation of name plate values indicated in the various Ten Year Site Plans (TYSPs) which are prepared by the three utility companies that maintain electrical generating capacity in the four county area. Of the three utility firms, (Florida Power and Light Company --FP&L, Florida Power Corporation -- FPC, and TECO) only TECO currently burns coal (of any quantity) to generate electricity. FPC's Bartow Number 1 unit does burn a coal-oil mixture (COM) at this time and is expected to continue until 1986. Both FPC and FP&L operate stations which have been identified and analyzed by the Economic Regulatory Administration for potential coal conversion (see Table 2.5.B). Under current conditions approximately 30.6 percent of total electrical output generated in this region is a result of coal combustion. If all candidate plants are converted (plus the Big Bend Number 4) come on line as scheduled, coal combustion will produce approximately 5926.9 MW or 84.3 percent of the electric power generated in this region (see Figure 2.5.A). Table 2.5.C indicated the combined output by the utilities by fuel type.

TABLE 2.5.B

ELECTRIC POWER PLANTS TAMPA BAY REGION

Utility	Plant	Unit	Type	Fuel	Gross Name Plate Wattage (MW)
TECO	Hookers Pt.	1	Fossil	H.Oil	33.0
		2	Fossil	H.Oil	34.50
		3	Fossil	H.Oil	34.50
		4	Fossil	H.Oil	49.0
		5	Fossil	H.Oil	81.6
	Gannon	1 ****	Fossil	H.Oil	125.0
		2 ****	Fossil	H.Oil	125.0
		3	Fossil	H.Oil	179.0
		4	Fossil	Coal	187.0
		5	Fossil	Coal	239.0
		6	Fossil	Coal	414.0
		GT 1		L.Oil	18.0
	Big Bend	1	Fossil	Coal	445.5
		2	Fossil	Coal	445.5
		3	Fossil	Coal	445.5
		4 **	Fossil	Coal	417.0
		GT 1	Combustion Turbine	L.Oil	18.0
		GT 2+3	Combustion Turbine	L.Oil	157.5
	McInnes ***	Unknown	Fossil	L.Oil	Unknown

ELECTRIC POWER PLANTS TAMPA BAY REGION (Continued)

Utility	Plant	Unit	Type	Fuel	Wattage (MW)[a]
FP&L	Manatee	1 *	Fossil	H.Oil	863.3
		2 *	Fossil	H.Oil	863.3
FPC	Bartow	1	Fossil	COM/HO	127.5
		2 *	Fossil	H.Oil	127.5
		3 *	Fossil	H.Oil/NG	239.4
		P1-4 (x)	Combustion Turbine	L.Oil	222.8
	Bayboro	P1-4	Combustion Turbine	L.Oil	226.8
	Anclote	1 *	Fossil	H.Oil	556.2
		2 *	Fossil	H.Oil	556.2
	Higgins	1	Fossil	H.Oil/NG	46.0
		2	Fossil	H.Oil/NG	46.0
		3	Fossil	H.Oil	46.0
		P-1 (x)	Combustion Turbine	L.Oil/NG	33.8
		P-2 (x)	Combustion Turbine	L.Oil/NG	33.8
		P-3 (x)	Combustion Turbine	L.Oil/NG	42.9
		P-4 (x)	Combustion Turbine	L.Oil/NG	42.9

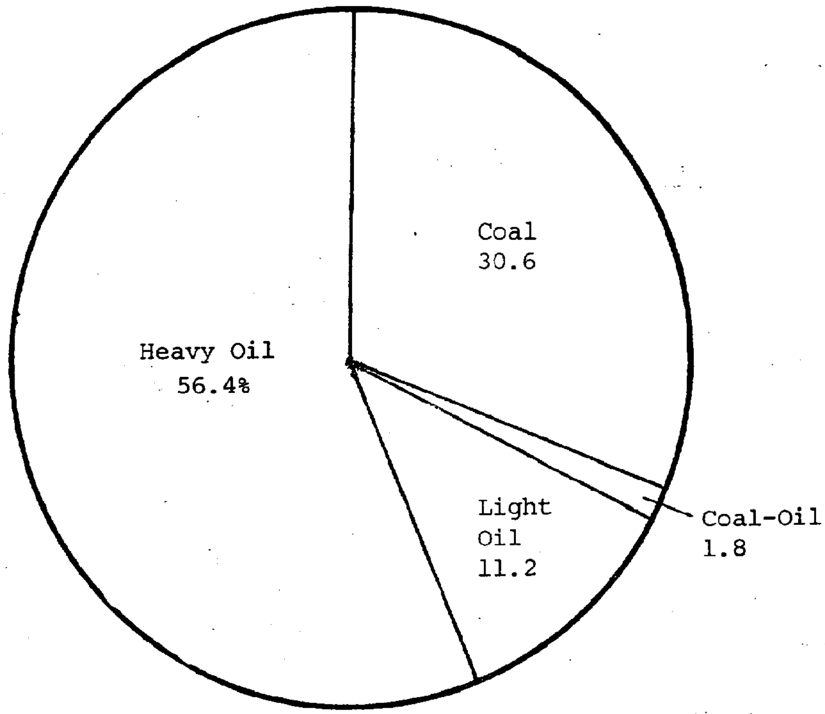
Sources: TECO, TYSP
FP&L, TYSP
FPC, TYSP

Notes:
- * proposed conversion candidate by ERA
- ** under construction
- *** proposed site - in service 1991 (currently on hold)
- **** to be converted to coal-one unit per year 1983-1986
- (x) Retired, extended stand by
- a Gross Name plate

FIGURE 2.5.A

Consumption by Tampa Bay Region Utilities

Existing Fuel Mix



Proposed Fuel Mix

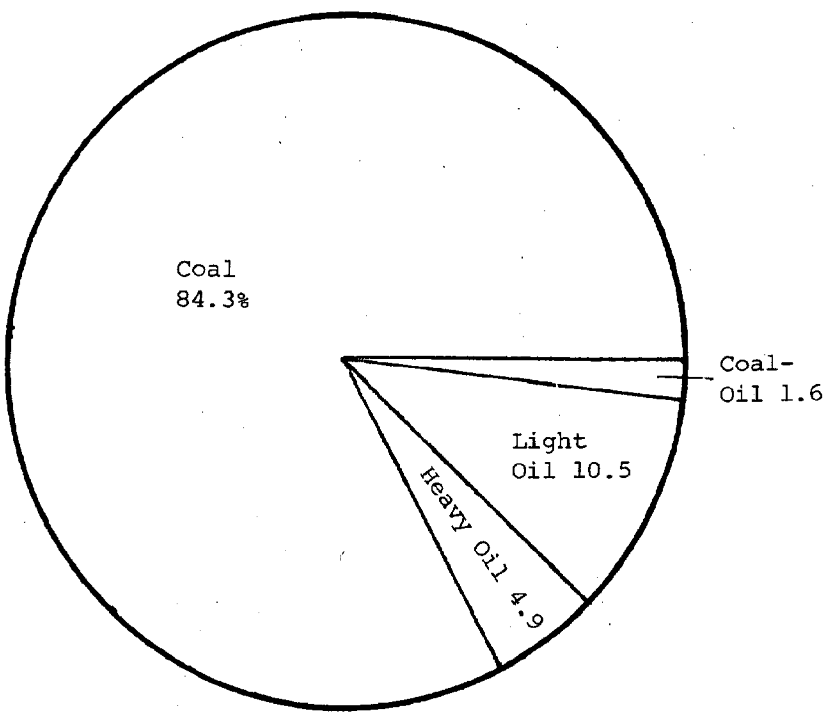


TABLE 2.5.C

TOTAL OUTPUT OF REGIONAL ELECTRIC POWER PLANTS
BY INPUT FUEL TYPE

COAL EXISTING

Fuel	Stations	Units	Output (MW)	Percent of Total Output (MW) Name plate
Coal (E)	2	7	2176.5	30.6
Coal (E+P)	5	14	5926.9	84.3
Heavy Oil (E)	6	17	4005.5	56.4
Heavy Oil (E+P)	2	8	370.6	4.9
Light Oil (E)	5	16	796.5	11.2
Coal-Oil (E)	1	1	127.5	1.8

Note: (E) Existing
(E+P) Existing and Proposed
(MW) Mega Watts

Source: TECO, TYSP
FP&L, TYSP
FPC, TYSP
TBRPC

2.6 CONVERSION CANDIDATES

The Economic Regulatory Administration (ERA) of the U.S. Department of Energy (DOE) at the request of the Florida Public Service Commission evaluated the feasibility of 14 generating stations (27 units) for conversion from residual fuels (heavy oil) to coal-fired steam generation. Of the 14 generating stations three are located in the Tampa Bay Region.

The three plants are:

1. Manatee Station, a 1,726.6 MW power plant with two units, located approximately 20 miles east of Bradenton, in Manatee County and is owned by Florida Power and Light Company.

2. Anclote Station, a 1,112.4 MW power plant with two units, located in the southwest corner of Pasco County just nort of the Pinellas County line, and is owned by Florida Power Corporation.

3. Bartow Station, a 717.2 MW power plant with three fossil steam units and four combustion turbine peaking units, located on Weedon Island, just northeast of St. Petersburg. Bartow Nr. 1 is currently burning a coal-oil mixtue (COM).

The ERA analyzed each of these three plants using engineering, environmental, and economic criteria which have been previously discussed. As a result of this study, the ERA stated that none of the conversion candidates were poor choices. However, each plant does have certain problems which must be resolved prior to initiation of conversion activities. A comparison of the plants is provided in Table 2.6.A.

The Manatee Plant has been considered as a good prospect for boiler conversion to coal based on a 20 percent derating (based on a review of the ERA feasibilty study the mean derating value was 32 percent with a standard deviation of 15 pecent). Thus, a derating of 20 percent is expected to be quite satisfactory. The plant's total land area, 8,091.6 acres is adequate to accommodate a coal handling and storage facility, particulate emission control equipment, and coal an ash handling systems. Currently, the plant receives residual fuel oil through a pipeline which originates at Port Manatee. However, Manatee County has an ordinance which prohibits coal combustion within the County (Article 1, Section 4). Without an amendment to this ordinance, this plant will be unable to convert to coal. The estimated capital cost for conversion is placed at $528.4 million which includes the installation of FGD equipment ($170 million); this cost is approximately 49.5 percent higher than Florida Power and Light investment in the plant. (FP & L, TYSP)

The Anclote plant received a poor conversion rating for engineering feasibility due to excessive boiler derating (30 percent for each boiler), inadequate upland storage area for coalhandling and storage facilities, and lack of adjacent transportation infrastructure (docks or rail spurs). ERA contends that the 404.69 acre site is of adequate size to accommodate particulate emission control equipment, but that there is insufficient area to locate fly ash ponds except for limited time periods (up to six months). Based on cost estimates generated by ERA, the $274,.4 million capital cost for coal conversion is 28.5 percent higher than the combined plant, equipment and site capital investment of $213.5 million. (FPC, TYSP)

The Bartow Plant received a good conversion rating based on the limited boiler derating, adequate barge docking facilities (which are in place), and adequate land area for paticulate emission control and coal handling and storage facilities. In addition, ERA contends that the land area of 1,348 acres is adequate to accommodate coal storage but is not sufficient for ash disposal. Based on cost estimates prepared by the ERA, the $94.6 million capital cost for coal conversion is 11.9 percent higher than the combined plant, equipment, and site capital investment of $82.7 million. (FPC, TYSP)

TABLE 2.6.A

COMPARISON OF COAL CONVERSION CANDIDATE PLANTS

Plant	Unit	Output (MW)	Estimated(a) Coal Use	Existing Delivery	Proposed Delivery	Nearest Rail	Nearest Barge
Manatee	1,2	1,726.6	2,116	Pipe	Rail	Extend(b)	+15 miles
Anclote	1,2	1,112.4	1,488	Pipe	Unknown(c)	1.5 miles	Unknown
Bartow	2,3	717.2	551	Barge	Barge	5.0 miles	Site

Sources: FP & L, TYSP, 1983
FP & L, TYSP, 1983
Tobin, R. L., et al, The Florida Statewide Coal Conversion Study, 1983

NOTES:
a. 1 x 10 Tons
b. Rail line could be easily extended per FP & L, TYSP.
c. Neither rail nor barge appear to be acceptable modes due to socio-economic and environmental disruption. A coal-oil mixture pipeline has been considered.

CHAPTER THREE

TRANSPORTATION OF COAL

3.1 FLORIDA RAILROAD NETWORK

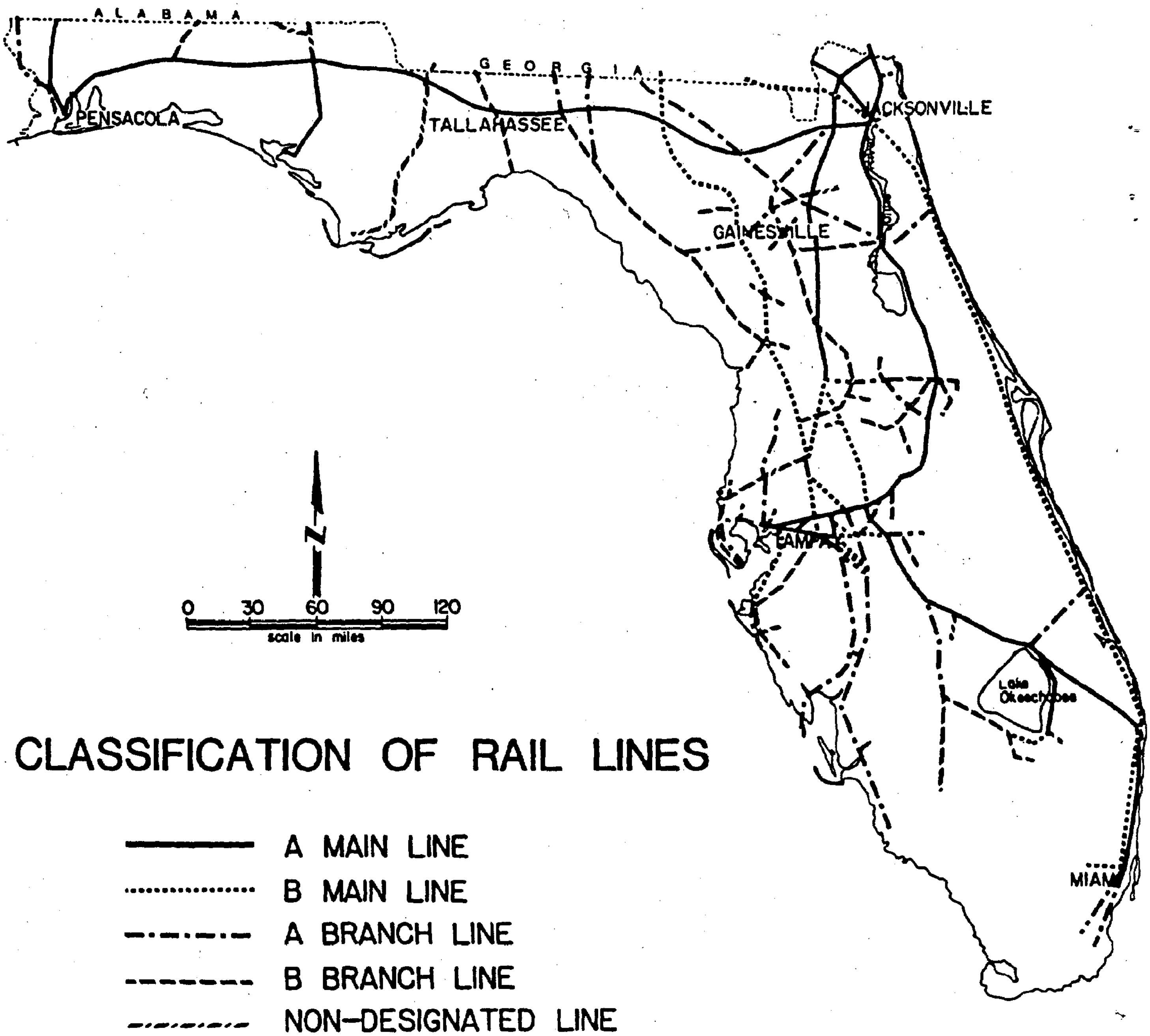
Florida is well served by a railroad network which is composed of approximately 4100 miles of trackage. The principal firm in the railroad industry in Florida is the Seaboard Systems Railroad (SSR) which is a member of the Chessie System. The SSR operates virtually all rail traffic on the Tampa Bay Areas's 287 miles of railroad trackage. Other railroad firms which operate in the state are the Norfolk-Southern Corporation, the Florida East Coast Railway, the Illinois Central Gulf Railroad and the Burlington-Northern. However, the Chessie System (CSX) owns 98 percent of all Class I railroad lines in the state and approximately 90 percent of the entire state network, (Wilbur Smith, 1980).

While several rail lines enter the state, the principal routes for coal unit trains cross into the state at Drifton or Jacksonville which are on CSX lines. The line from Jacksonville to Baldwin carries between 1 to 5 million tons of coal per annum without new coal plant construction or further conversion. (Tobin, 1983)

3.2 TRANSPORTATION MODES IN THE TAMPA AREA

The Tampa Bay Region contains all the necessary transportation infrastructure to accommodate the conversion of oil-fired electrical generation plants as well as expansion of existing coal-fired stations. Existing harbor facilities in Tampa Bay combine to facilitate the movement of 49.6 million tons of bulk and general cargo. The west central area of Florida is served by 287 miles of rail line. (Wilbur-Smith, 1980)

FIGURE 3.1.A



Source: Florida Department of Transportation

TABLE 3.1.A

CLASSIFICATION AND MILEAGE OF RAIL LINES

Category	Description	Designated Line Miles In Florida
A Main Line	Twenty million or more gross ton-miles per mile per year ("gross tons") or, Serves 75,000 annual carload market, or Provides through rail in corridors designated as essential in the Strategic Rail Corridor Network for national defense.	1132
B Main Line	Less than twenty million gross tons but at least five million.	839
A Branch Line	Less than five million gross tons but at least one million.	807
B Branch Line	Less than one million gross tons	1075
Non-Designated Line	Includes urban lines, Class II lines and reported line abandonments.	237
TOTAL		4090

Source: Florida Department of Transportation

All but 20 miles of the rail network is composed of 115 pound rail which is capable of handling loads up to 11 million tons per annum. The remaining 20 miles consists of 132 pound rail which is designed to accommodate combined rail shipments in excess of 11 million tons per annum (Wilbur Smith, 1980)

Lastly, the region is served by a network of interstate, arterial, and collector highways. Due to its interstate network, the Tampa Bay Region enjoys excellent linkage to the northeast and northcentral United States, plus intra-state connections via the Federal Aid Primary system, State Road 60, US 301, US 41 and US 19. The highway system is envisioned as a means to arrive at a final destination or begin a freight journey as long distance truck transport of bulk cargoes is normally not considered to be cost-effective. Therefore, the study will concentrate on barge and rail movements of coal since the majority by weight is moved by rail and barge and cost per ton mile favors transport by barge due to lower energy and labor charges.

3.2.1 Rail Transport in the Tampa Bay Area

The greatest single cargo for rail in the Tampa Bay Area is dry and liquid phosphate. The majority of this movement is from the mines which are generally located in eastern Hillsborough, Polk, and Manatee Counties to the port areas. It passes through the Valrico and Yeoman yards in Hillsborough County; these yards are subjected to more tonnage than any other line segment on the Seaboard Coastline system in the Tampa Bay Area (Wilbur Smith, 1980).

Phosphate and coal are both considered as dry bulk cargos and, thus, have similar transport charcteristics. The cargoes are moved via 70 to 100 hopper car unit trains which are composed of 60 to 100 ton capacity cars. Generally, the cargo is down loaded (filled to less than capacity) and moistened to reduce fugitive dust emissions which are a deleterious output of dry bulk transport. Due to changes in the fleet mix, more 100 ton open hopper cars are being added to the fleet as the older 60 to 80 ton cars are retired.

The Chessie System which includes the Seaboard Systems, the Chesapeake and Ohio, the Baltimore and Ohio, and the Louisville and Nashville-Clinchfield Railroads combine to transport more than half the coal mined in the United States. Currently, the fleet mix favors the 80 ton, three pocket, open hopper car with an approximate 39 percent plurality (see Table 3.2.1.A). It should also be noted that utilities often own rail cars and engines thus insuring the availability of transport capacity.

TABLE 3.2.1.A

LOUISVILLE AND NASHVILLE-CLINCHFIELD
COAL CARRYING EQUIPMENT

Car Type	Average Cubical Capacity	Number of Cars	Percent of Fleet
60-Ton	2,543	2,300	8.1
Two-Pocket		2,300	8.1
70-Ton	2,733	2,817	10.0
Three-Pocket	2,750	4,353	15.4
		7,170	25.4
80-Ton	2,962	7,965	28.2
Three-Pocket	2,713	3,039	10.8
		11,004	38.9
100-Ton	3,600	99	0.4
Three-Pocket	3,436	760	2.7
	3,301	106	0.4
	3,407	14	0.1
	3,374	6,806	24.1
		7,785	27.5
TOTAL		28,259	100.0

Source: The Family Lines Rail System, Louisville & Nashville and Clinchfield Railroads Coal Mine Directory and Coal Transportation Guide, 1981.

Based on a review of existing coal movements, final coal deliveries vary somewhat in the Tampa Bay Area when compared to the statewide study conducted by the Economic Regulatory Administration. On a statewide basis, the modal choice is rail transport, however current delivery to coal-fired plants in Tampa favors barge transport. This picture should change with the conversion of the three oil-fired units at Gannon Station from a mix which favors rail transport to a more equalized delivery system (see Table 3.2.1.B).

TABLE 3.2.1.B

FINAL COAL DELIVERIES PERCENTAGES BY MODAL CHOICE

Mode	Statewide(a)	Tampa Bay(b)	Tampa Bay*
Rail	42.3	38.6	48.7
Inland Water	22.9	0.0	0.0
Ocean Vessel	34.8	61.4	51.3
TOTAL			429.2

Source: a. Tobin, et al, <u>The Florida Statewide Coal Conversion Study</u>, 1983.

b. TECO, <u>TYSP</u>, 1983.

Notes: * Includes Gannon 1-3 Conversion

3.2.2 Barge Transport in the Tampa Bay Area

Barge shipment of coal to Big Bend Units 1-3 comprises practically 100 percent of all water-borne coal transport into Tampa Bay. As the Gannon Units 1-3 are converted to coal, shipments of the fossil fuel will continue by rail. Since residual fuel is received by Gannon via barge, this mode shift represents a slight decrease in water-borne traffic in favor of rail delivery. This will lead to a slight increase in rail mode choice of approximately 10.0 percent.

Due to the proximity of the Port of Tampa and Port Manatee and the location of most plants along the water, it is assumed that barge delivery will be the most used mode of coal transport. It should be noted that where water-borne delivery is not indicated as the primary mode as reported in the Ten-Year Site Plans, it was selected as the secondary choice. This strategy allows for diversification of modal choice as well as coal seam source. Such a policy helps to reduce supply disruptions due to natural disasters, weather conditions, job actions and equipment shortages and therefore guarantees greater steam coal availability to the generating stations.

Barge traffic in Tampa Bay amounts to approximately 1,600 one-way trips per annum. Combined barge tonnage recorded during December 1982 through November 1983 amounted to approximately 21.4 million tons or nearly 43.1 percent of the total tonnage handled through the two parts. Cargo carried by barge traffic can be characterized as dry bulk or petroleum since all coal (3,305 Thousand Short Tons), an average of 76.2 percent of the petroleum (8,597.5 Thousand Short tons), and an average of 34.4 percent of all phosphate products or (6,604 Thousand Short Tons) are transported via barge. The following exhibit indicates the impact on the harbors caused by barge operations at the Port of Tampa.

TABLE 3.2.2.A

RANKING CARGOES BY TON INTO TAMPA

			Amounts	Percent (Ships/Barges)	SHORT TONS	
Month	Phosphate(a)		Petroleum(b)		Coal(c)	Total Ton (d)
12/82	1,420,356	(80/20)	927.112	(32/68)	349,040	2,755,445
1/83	1,743,398	(73/27)	600.973	(20/80)	325,262	3,448,037
2/83	1,576,667	(68/32)	1,025,272	(23/77)	231,463	3,517,064
3/83	1,722,955	(67/33)	990,044	(34/66)	238,150	3,719,143
4/83	1,749,040	(65/35)	1,107,717	(25/75)	195,000	3,766,609
5/83	1,713,023	(60/40)	1,138,257	(29/71)	255,090	4,064,931
6/83	1,659,728	(67/33)	879,984	(12/88)	152,670	3,301,109
7/83	1,862,078	(62/38)	1,034,696	(27/73)	340,044	3,920,057
8/83	2,213,864	(65/35)	850,401	(17/83)	388,162	4,056,218
9/83	1,898,321	(58/42)	951,770	(27/73)	351,280	3,918,578
10/83	2,189,448	(58/42)	970,121	(18/82)	232,345	3,966,768
11/83	1,638,429	(64/36)	860,473	(22/78)	277,042	3,412,162
TOTAL	19,197,986		11,282,820		3,305,548	43,846,121

Source: Tampa Port Authority

NOTES:
- (a) Dry bulk/Chemicals Combined
- (b) All petroleum products including asphalt
- (c) All movement by barge unless specified
- (d) Total tonnage moved through the Port of Tampa

TABLE 3.2.2.B

TOTAL BARGE TRAFFIC AT PORT OF TAMPA

Month	Number	Tons	Percent Activity Total
12/82	76	609,124	28.4%
1/83	80	1,338,125	38.8%
2/83	80	1,585,402	45.1%
3/83	84	1,540,613	41.4%
4/83	87	1,700,906	45.2%
5/83	111	1,821,123	44.8%
6/83	94	1,527,718	46.3%
7/83	124	1,867,711	47.6%
8/83	109	1,938,359	47.8%
9/83	99	1,857,607	47.4%
10/83	114	2,021,940	51.0%
11/83	85	1,537,655	45.1%
TOTAL	1,143	19,346,283	

Source: Tampa Port Authority

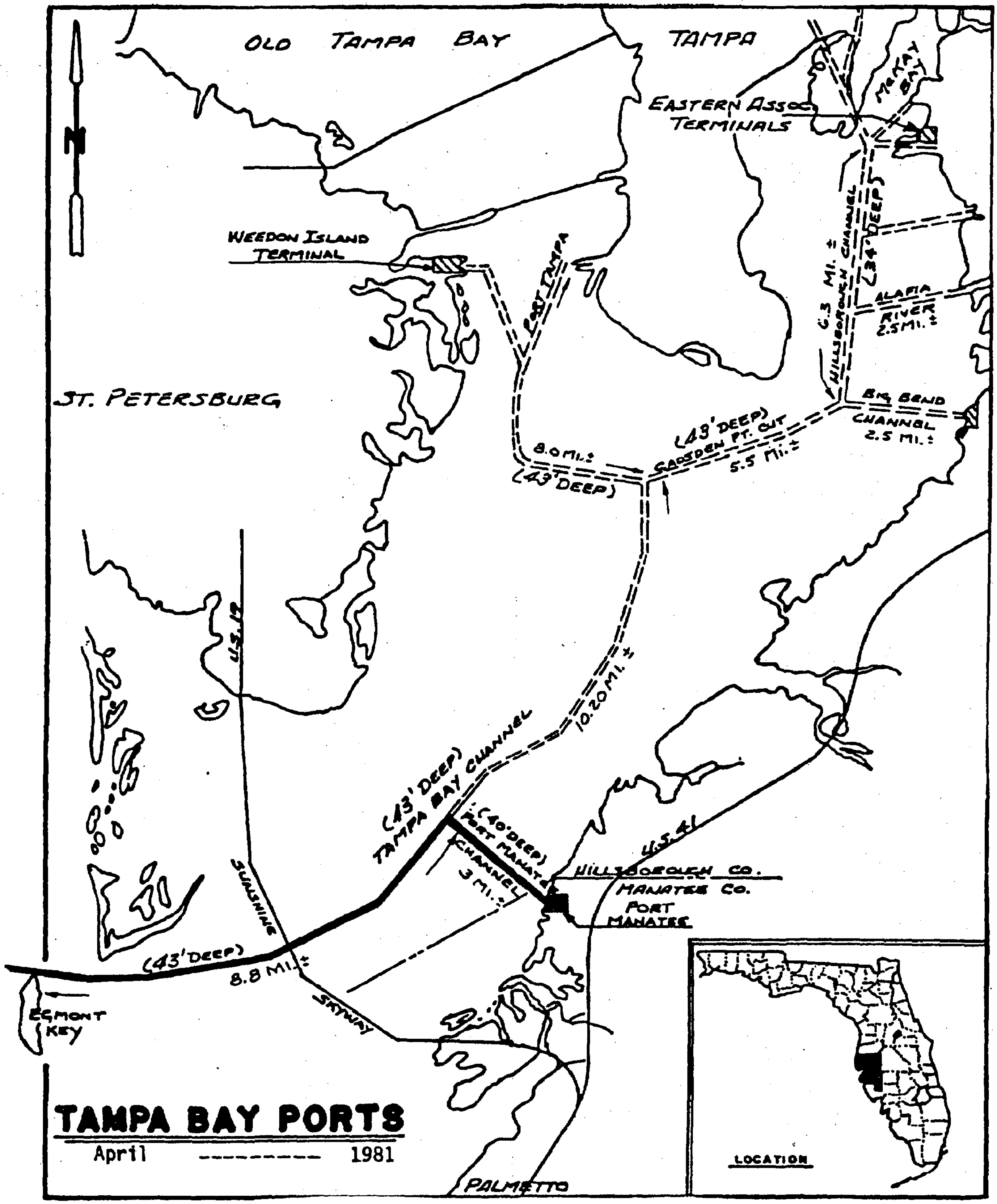
EXHIBIT

TOTAL BARGE TRAFFIC AT PORT MANATEE

Registered Gross Tons	Number
0- 999	192
1,000- 4,999	86
5,000- 9,999	116
10,000-14,999	46
15,000-19,999	13
20,000-24,999	0
25,000-29,999	2
30,000+	0
TOTAL	455

Source: Manatee County Port Authority

FIGURE 3.2.2.A
Tampa Bay Port and Channel Locations
Barge Routes to Power Stations



SOURCE: Manatee Port Authority

In reviewing the shipping statistics prepared by the Tampa and Manatee County Port Authorities, a total of 4,588 vessels including merchant ships, tug boats, and barges called upon the two ports in a one year period (December 1982 - November 1983). Therefore, a daily volume of 13 vessels has been derived. Increases in vessel operations are expected for both ports on the order of nine percent at the Port of Tampa and 12.7 percent at Port Manatee (Tampa Port Authority and Post, Buckley, Schuh & Jernigan, Inc., 1981).

In order to reach the existing and proposed coal-fired electrical generating stations, no extensive dredging will be required. This is true for all shore-line stations except for Anclote where it has been stated that such dredging is impractical. This is based on the existing and proposed locations of the stations and their proximity to existing channels. Periodic channel maintenance dredging will be required, but this would occur without any conversion or new plant construction.

3.2.3 TRUCK TRANSPORT IN THE TAMPA BAY AREA

Virtually all coal which is consumed in the Tampa Bay Area is used to create steam which in turn helps to generate electricity. A small amount (less than 5 thousand tons per annum) is used for industrial purposes. As discussed previously, steam coal which is used by the electric utilities is transported by ocean-going barge or by unit train. Therefore truck transport of coal, except in small quantities does not occur in the area.

This situation should continue as truck transport is the least effecient means of continuously moving large amounts of bulk cargo. For example, based on both capital and labor productivity per ton/miles per dollar, water transport is practically 40 times more labor productive and almost 8 times more capital productive than truck transport (Eastman, 1982).

Repeated heavy truck transport can cause the hastened deterioration of the wearing course and the subgrade of a roadway. For instance, the conversion of the two units at the Anclote plant would generate a demand for 1488 Thousand Short Tons per annum (Scientific Aplications, Inc., 1983); this is based on a BTU content of 12,000 BTU/pound. If this coal was transported via 36 ton truck (25 tons net cargo weight), it would require 59,520 trips per annum or approximately 166 per day or practically one trip every nine minutes. Such wear on the pavement and the subgrade generated only by the coal movement and not including employees or even background traffic would cause the structual failure of a standard collector roadway section much earlier than would be caused by the background traffic alone. (Florida Department of Transportation, 1980). A further problem to truck transport of large quantities of coal is the great potential for neghborhood disruption caused by the continuous coal-bearing truck traffic; noise, congestion, and fugitive dust emission are all concerns of transport via truck mode.

3.3 PIPELINE POTENTIAL

Currently the Anclote and Manatee conversion candidates receive residual fuel from pipelines. However, converison to coal requires a modal change in delivery unless the coal is transported in some type of slurry media. Typical slurry media includes a coal-oil mixture (COM) which is a 50-50 suspension of pulverized coal and residual oil, or a coal-water mixture (CWM) or more currently referred to as a coal-water fuel (CWF) which is similar to COM except that water and an additive agent replace the oil as the media. Industry trend is to C-W-F which can be burned directly.

As discussed previously, coal-slurry pipelines must be appropriately sized and all receiving stations must be located during the planning process. This is due to the problem with making post-construction connections.

If the construction and media integrity problems can be overcome, the energy and transport costs of the pipeline is highly competitive with both rail and water transport. In a symposium conducted by the Maritime Transportation Research Board, it was presented that pipeline transport costs varied considerably with the volume carried, whereas total rail transportation costs are closely rated to the volume carried. Therefore, as the volume carried increases,total rail costs increase proportionally, but as the volume carried by the pipeline increases, the unit cost decreases.

Based on operational considerations, energy consumption for barge and pipeline transport are very similar, however rail transport is far more energy intensive (See Table 3.3.A). Truck transport energy consumption data was not available, but it would undoubtedly be far more intensive than any of the three modes discussed above.

TABLE 3.3.A

ENERGY EFFICIENCY OF TRANSPORT MODES

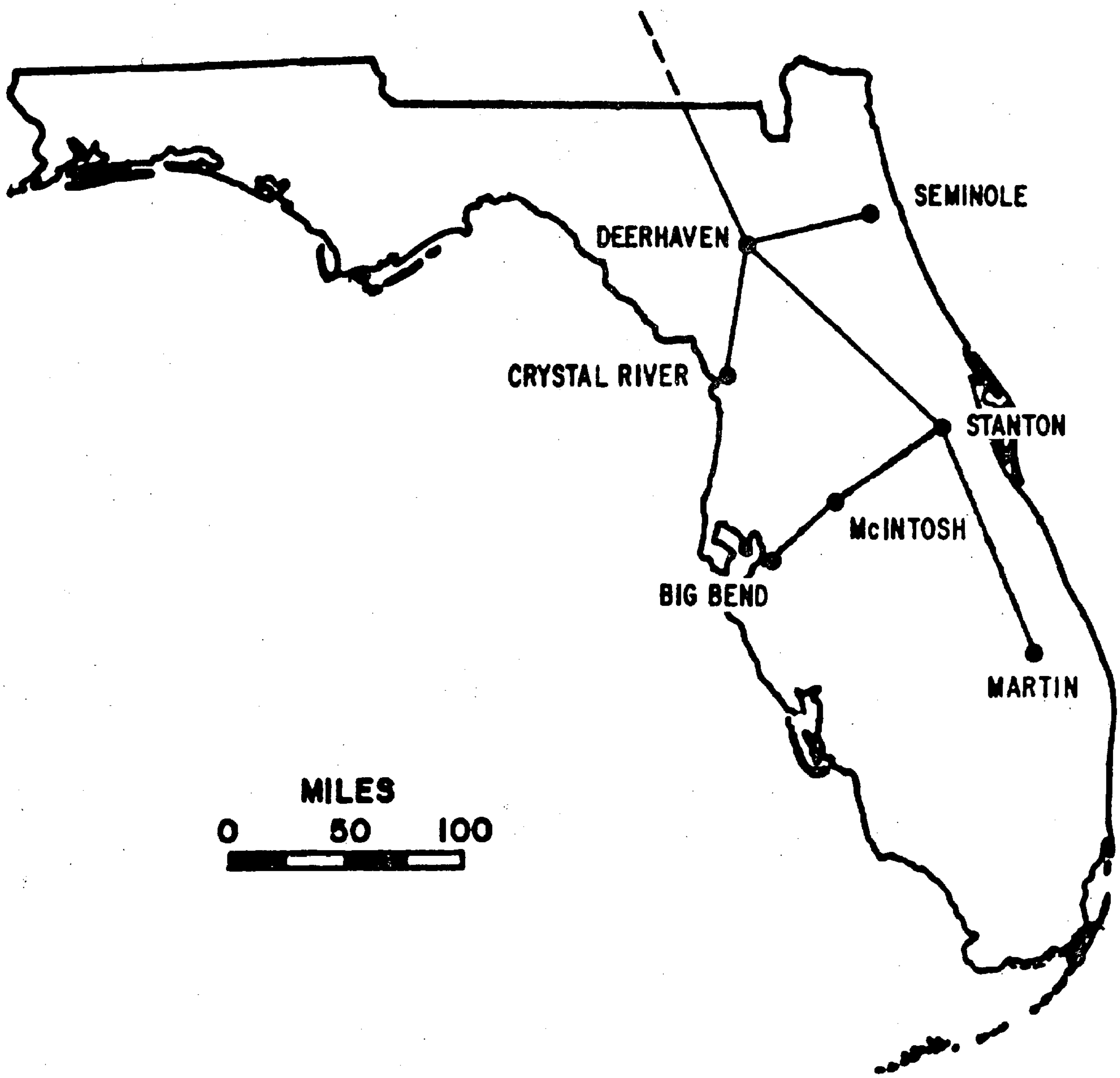
MODE	BTU/TON/MILE
Rail	686
Barge	270
Slurry Pipeline	204

Source: 1. Eastman, S.E., "Selected Productivity Comparisons in Surface Freight Transportation," Transportation Research Record Nr. 880, 1982

2. Zandi, I. and K.K. Gim, Transport of Solid Commodities Via Freight Pipeline, 1976.

FIGURE 3.3.A

Potential Slurry Pipeline Routes



Source: Economic Regulatory Administration, 1983

CHAPTER FOUR

STORAGE OF COAL

4.1 EXISTING FACILITIES

As noted earlier in this report, the only existing coal-fired electrical generation plants are owned by the Tampa Electric Company and is located in Hillsborough County at Big Bend and Gannon which are situated on the eastern shoreline of Hillsborough Bay. Currently the three units at Gannon burn coal to generate a maximum output of approximately 840.9 MW. The three units at Big Bend generate a combined maximum output of 1336.5 MW.

Based on a review of TECO's most recent TYSP, a fourth coal-fired unit will be on line at Big Bend in May of 1985. The additional unit will add 486 MW to the station's output. Beyond this addition, three existing oil-fired units at Gannon Station are scheduled for conversion. The following exhibit indicates the proposed completion and in service estimate.

TABLE 4.1.A

ADDITIONAL COAL-FIRED UNITS
IN-SERVICE ESTIMATE AND OUTPUT

UTILITY	PLANT	UNIT	IN-SERVICE	OUTPUT (MW
TECO	Big Bend	4	April 1985	486.0
TECO	Gannon	1	March 1986	125.0 *
TECO	Gannon	2	August 1985	125.0 *
TECO	Gannon	3	July 1984	179.5 *
NEW OUTPUT				486.0
NEW COAL-FIRED OUTPUT				915.5

Source: TECO, TYSP

Note: * Represents no increase over previous oil-fired output

Currently, coal is stored at both the Gannon and Big Bend power stations, it is moved around the site via conveyor belt system. An adequate supply is maintained to allow for 60 to 90 days of normal operations.

Allowing for the programmed conversion of the three Gannon units and the additional on-line service of Big Bend Unit 4, it can be assumed that, without further conversion, a total of 6,890 Thousand Short Tons would be consumed per annum. To maintain a 90 day normal operating supply, an estimated 1722.5 Thousand Short Tons would need to be stored on site. This is based on an assumption that 2280.5 short tons per year are consumed per megawatt produced (EPA, 1982).

TABLE 4.1.B

ESTIMATED COAL CONSUMPTION OF EXISTING AND COMMITTED COAL-FIRED UTILITIES

Plant/units	MW	Coal Used (Tons)
Gannon 1	125.0	285,062.5
Gannon 2	125.0	285,062.5
Gannon 3	179.0	408,209.5
Gannon 4	187.0	426,453.5
Gannon 5	239.0	545,039.5
Gannon 6	414.0	944,127.0
Big Bend 1	445.5	1015,962.8
Big Bend 2	445.5	1015,962.8
Big Bend 3	445.5	1015,962.8
Big Bend 4	417.0	950,968.5

Source: TECO, TYSP
EPA, Final Environmental Impact Statement, Tampa Electric Company Big Bend Unit 4, 1982

Note: 2280.5 Tons/Year = 1 MW/Year

4.2 LOCAL IMPLICATIONS

Assuming that some conversion candidate stations did make the switch to coal for steam generations, and the utility firms desired coal handling and storage facilities (CHSFs) in close proximity to their plants, several additional facilities would need to be developed within different jurisdictions. Currently, the only CHSFs are located in Hillsborough County. However if all plants are converted, several local governments will be faced with developing standards to guide construction and operation of CHSFs.

TABLE 4.2.A

EXISTING, COMMITTED AND CANDIDATE COAL PLANTS
LOCAL JURISDICTION

UTILITY	PLANT	LOCAL JURISDICTION
TECO	Gannon	Hillsborough County
	Big Bend	Hillsborough County
FPC	Anclote	Pasco County
	Bartow	Pinellas County, St. Petersburg *
FP&L	Manatee	Manatee County

Source: TBRPC

Note: * Bartow site is contiguous to the City of St. Petersburg

As a part of this study the TBRPC requested zoning and other pertinent development regulations which would be used by the local government having jurisdiction over site design, land use consistency and zoning conformity of the proposed CHSF. TBRPC contacted the following local governments:

Hillsborough County
City of Tampa
Pinellas County
City of St. Petersburg
Pasco County
Manatee County

Each of the jurisdictions responded to the request and their responses are appended to this report.

Hillsborough County lists coal refining and distillation as a conditional use within the M-1 Industrial District. As a conditional use, a CHSF may be permitted only after a "..special review by the Board of Adjustment to determine that the...hazards can be controlled to the degree which will render any said use compatible with the particular location for which it is proposed." (Section 34.B. Zoning Code of Hillsborough County) Buffering and other special conditions may be applied by the Board of Adjustment.

The City of Tampa is currently revising its zoning code. Under the existing code, coal storage is permitted in a M-2 Heavy Industrial District, once the revised code has been adopted, CHSFs can only be located in IH districts. Review by the Board of Adjustment is similar to what has been previously mentioned.

Pinellas County does not list coal storage, per se, but does indicate that similar industrial operations and activities to those enumerated under Permitted Uses are appropriate in the M-1 Light Manufacturing and Industry District. No action by a Board of Adjustment is required. The M-2 Manufacturing Industry District also appears to permit development of a CHSF. Acceptability of the proposed use within either of the two industrial districts appears to be a function of compliance with performance standards which are presented in Section XIX of the Zoning Code of Pinellas County.

The City of St. Petersburg does not specify CHSFs within its IG Industrial General District, however under Section 64.328 "Bulk Storage" "Freight handling facilities" and "Utility plants and substations" are permitted subject to site plan approval and other conditions. Buffering is required.

Pasco County does not specify coal handling facilities in its I-2 General Industrial Park District (Article XX). Similar to other local zoning ordinances, there are several similar uses such as storage of gasoline and liquified petroleum gases and refineries. The Pasco ordinance also requires compliance with performance standards and buffering.

Manatee County does not specify coal storage but does indicate that Special Permit Uses (governed by Sections 405F and 205A of the Zoning Code and granted by the Board of County Commissioners) may authorize the development of "Electric power plants" and "Other heavy utility uses" in the M-1, Light

Industrial District, and the M-2, Heavy Industrial District. However, as discussed previously, Manatee County prohibits the burning of coal by ordinance, thus "utility uses" which appears to be an accessory use to power plants seems to hold little meaning for coal use.

This limited perusal of the zoning codes of the aforementioned local governments does appear to indicate that, prior to any large scale conversion effort, local development regulations should be amended to clarify the appropriateness of CHSF location within any specified district. Logically, CHSFs should be situated in industrial districts which conform to adopted land use plans.

4.3 CRITERIA FOR LOCATION AND DEVELOPMENT OF COAL HANDLING AND STORAGE FACILITIES

Coal handling and storage facilities already exist in the Tampa Bay area. Conversion of existing oil-fired plants and development of new-coal fired units will generate a demand for additional CHSFs or expansion of existing facilities. In an area of rapid residential and commercial development, such as the Tampa Bay Region, caution must be taken in the selection of sites for future coal storage facilities. Several considerations must accompany any site selection.

Large areas must be selected on which enough coal can be stored to accomodate 90 days of average daily consumption retain the height restriction required for the zone, and still afford a buffering area of sufficient size to limit noise, fugitive dust, glare and other noxious airborne outputs. These areas should be zoned for industrial or heavy industrial use and should conform to an adopted land use plan.

If the site is not contiguous to the power station, transport of the coal should be accomplished by a means which will not disrupt the existing transportation system. Truck transport of coal should be discouraged due to the higher costs and acceleration of pavement and subgrade deterioration of the roadway.

Due to the nature of the characteristics of stormwater run-off from coal storage facilities, CHSFs should not be situated where sheet flow could reach Class I or Class II water bodies which have been designated by the State of Florida. Run-off from coal storage areas could contain trace metals such as iron, manganese, arsenic, cadmium, mercury, selenium, and others.

Another environmental concern is the generation of fugitive dust. This is a problem not only in storage but in intra-site transportation. Several different methods can be employed to control fugitive particulate emissions such as enclosed conveyors, water spray dust suppression systems.

Still another concern relating to the design of coal storage facilities is the potential of leaching of trace metals into the ground water table. The minerals which characterize stormwater run-off, which is discussed above, can also enter the groundwater by leaching through soils found beneath the coal stacks. Therefore the area beneath and adjacent to the stack should be lined with a high density polyethylene fabric liner, or similar barrier.

These aforementioned contaminants should be trapped by the plastic liners, which are referenced above, used in retention ponds. Therefore, periodically, the contaminants should be removed or dredged and then properly deposited in a licensed sanitary landfill.

Finally, the CHSF should be located in an area which can be served by more than one transport mode, preferrably a site with barge as well as rail access. Having bi-modal access avoids a wedding to one mode thus endangering a continuous flow of coal due to weather conditions, infrastructual problems, job actions, and other unforeseen maladies.

The aforementioned concerns are not novel or unique, they are areas which must be addressed to accomodate the development and operation of a coal facility. The Jacksonville Electric Authority (JEA) is building two 600 MW coal-fired electric generating units and a CHSF to support them.

The following is an excerpt from a JEA report which addreses certain environmental concerns, intra-site transmission and sizing of coal storage piles for the St. Johns River Power Park.

EXCERPTS FROM JACKSONVILLE ELECTRIC AUTHORITY'S PLAN
FOR ST. JOHNS RIVER POWER PARK COAL HANDLING AND STORAGE FACILITY

Fugitive Particulates

Control and collection of fugitive particulates in the coal handling system will be accomplished by several different methods including, totally enclosed conveyors, water spray dust suppression systems and dry dust collection systems utilizing fabric filters. All dry dust collection systems will have dust collection efficiencies of 99.9% and discharge opacities of less than or equal to 10%. Water spray dust suppression systems, which operate automatically when coal is flowing, will be located in the following areas:

- coal rotary car dumper

- stacker-reclaimer at bucket wheel and all conveyor belt transfer points including those to and from the yard conveyors

- coal emergency stackout around and within the lowering well

Groundwater Leachate

The coal pile area will be lined with a high density polyethylene liner to preclude seepage of leachate into the groundwater. The Coal Pile Runoff Sedimentation Pond will also be lined with a similar material to prevent infiltration of coal pile runoff.

Stormwater Runoff

All stormwater runoff from coal handling and storage areas will be sent to the Coal Pile Runoff Sedimentation Pond. Effluent from this lined pond will be sent to the plant Wastewate Treatment Facility for further treatment to meet final effluent limitations.

Intra-site Transmission

Figure 1 illustrates the coal handling system at SJRPP. Coal is delivered to the site by railcar and dumped via rotary car dumper into a hopper. Conveyor C-1 transports the coal from the hopper to the transfer house for emergency stackout or transfers to conveyor C-2 to the coal handling building. After entering the coal handling building, the coal is either conveyed (C-4) to yard storage or sent to the crusher surge bin and through the crushers. The crushed coal is then conveyed (C-7, C-8) to the house/tripper floor where the coal silos are filled. Each coal silo feeds its own pulverizer which then feeds the boiler. A rail-mounted stacker/relaimer will be used to stack-out and reclaim coal from active storage.

Coal Storage Piles

The live storage pile is sized to store a three day supply; sufficient for daily consumption by the two 600 MW units operating a full load over an extended weekend. This amounts to 39,000 tons of live storage arranged in two parallel piles on each site of the stacker-reclaimer track.

The long term storage coal pile will be sized to store a 90-day supply of coal. However, the normal inventory will be 60 to 90 days supply.

Source: Jacksonville Electric Authority, 1984

The Tampa Port Authority is considering the phased development of a 24 Million Short Ton (MST) per annum coal handling and storage facility. The proposed project would be developed in four phases designed to accomodate 6 MST per year.

Fugitive Particulates

To control the fugitive dusts, the facility would be designed with the use of Best Available Control Technologies (BACT). At the railroad car loading facilities, the loadout chute can be equipped with dust control suppression sprays. All main conveyors, excluding yard belts, will be equipped with covers that enclose the belt and material, preventing losses caused by wind or rain. All transfer points will be fully enclosed and equipped with a dust control bagfilter unit that will develop a negative pressure within the chute and not rely on water sprays. The collected material would return directly to the conveyor belt and avoid the problems of rehandling collected dusts. Ship unloading would be by a single traveling clamshell bucket rather than a tandem. Yard conveying, stackout, and reclaim are by conventional equipment. Coal pile configurations would be designed for soil bearing pressures of 3,000 psf. Fugitive dust and black water runoff control would be considered and controlled. The stockpiles would have a low profile, which will help reduce exposure to wind. When being placed, the stacker will be operated to minimize free-fall of the coal, and water suppression sprays will be used. The stockpiles can also be sprayed with a latex crusting agent if they are to remain in storage for any length of time. At the barge and ship unloaders, dust suppression sprays will be employed.

Groundwater Leachate

The TPA is assuming that their engineers will encounter a high water table at the proposed Port Redwing site. Therefore a soil bearing pressure of 3,000 pounds per square foot is vital. As in the example of JEA, a high density plastic fabric liner should be used beneath each coal stack.

Stormwater Run-off

To prevent coal spillage from the high level transfer conveyor, trays can be provided directly beneath, and fitted with quick disconnects for easy clean out. Use of this tecnique will prevent spillage of coal dusts and fines which could find their way into the shipping channels. The site will be graded to collect the runoff water from the storage piles. Furthermore, the site will be designed to prevent the contamination of ground water by the wastewater. Collection of the contaminated water will take place at the west end of the site, and will be pumped to 2 treatment ponds. The first will act as a containment pond, and water will then be pumped at a controlled rate to the second pond where it will be treated as necessary. This will remove suspended solids and produce a water quality to meet Federal and State water discharge quality requirements. The system would be capable of handling a 10-year storm and meeting 1-hour retention requirements to maintain the permitted quality level of discharge.

Intra-Site Transmission

Movement of coal from the ship unloaders would be by a collection conveyor. Coal would then be transferred to the sampling/transfer tower and then to yard belts for stack-out. Incoming coal would be weighed by a belt scale mounted on the conveyor to the sampling tower. These type of scales are acceptable for verification of coal received when properly calibrated. Capacity of the conveyor systems will be designed for 4,500 st/h peak capacity (4,000 st/h average). The use of 72-inch belts with 35 degrees troughing idlers and running at a nominal speed of 700 feet per minute (fpm) would be adequate.

Sampling of the incoming coals would be accomplished in the sample/transfer tower by the use of a 2 or 3 stage mechanical sampling system capable of meeting the latest revisions of ASTM D2234 and D2013.

The sampling/transfer tower chute work would be designed initially to transfer coal to additional yard belts as required. This will permit additional storage capability to be added at a later date without a disruption of current operations. A travelling boom stacker with a length of 150 feet is required due to assumed soil conditions. The yard belt, tripper, and stacker would again utilize 72-inch belting at a nominal 700 fpm. This system could produce a stock-pile 210 feet long (toe to toe) with a maximum height of 55 feet to meet soil bearing criteria. Configurations on the site plan permit each pile to contain a maximum total storage of 300,000 short tons with 2 piles being serviced by a one-boom stacker. Reclaim methods are limited to surface types only, and therefore limited to the following: a) dozing to pocket, b) reclaim by track mounted bucket wheel, c) bucket wheel stacker/reclaimer, or d) mobile bucket wheel reclaimers. Dozing was rejected because it would be too expensive and impractical at the nominal 4,000 st/h loading rate. Track mounted bucket reclaim systems are too expensive, and the use of a bucket wheel stacker/reclaimer was rejected due to the fact that this system cannot stack-out and reclaim at the same time without requiring two units. Consequently, a single crawler-mounted, mobile bucket wheel reclaimer capable of reclaiming at the nominal 4,000 st/h rate has been included in the system. One reclaimer will service piles produced by the boom stacker and will be in balance with the yard belt system. In the unit train loadout mode, the bucket wheel reclaimer(s) will reclaim coal at a nominal rate of 4,000 st/h to the yard belt. The yard belts will then delive the coal to a sampling, withing, and loadout facility. Coal will report to the unit train at this point in batched amounts of 100 tons for each railcar. Sampling will be similar to that described for the ship unloading.

It should be noted that the JEA facility is under construction while the TPA facility is currently being studied for feasibility. However both facilities appear to be considering designs which will mitigate deleterious environmental impacts.

CHAPTER FIVE

TRANSPORTATION SCENARIOS

The Regional Coal Study Advisory Committee adopted a position that an appropriate manner to assess potential transportation deficiencies was to devise a series of scenarios which would depict various mixtures of transport modes.

Using information presented in a previous study conducted by the Argonne National Laboratory (ANL) for the U.S. Department of Energy, projected coal demands were calculated for each of the five electric generation plants located in the four-county region. ANL assumed that one pound of coal would create 12000 Btu's. Unless otherwise noted, ocean-going barges were assumed to be loaded to or near their capacity of an estimated 22,000 short-tons. The rail cars are then aggregated into dedicated unit trains (a train which is dedicated from a single origin to a single destination) which is composed of 75 open-hopper cars.

For the purpose of analysis, five scenarios were developed:

1. Scenario A: All barge transport of coal
2. Scenario B: 2/3 barge and 1/3 rail
3. Scenario C: 1/3 barge and 2/3 rail
4. Scenario D: All rail
5. Scenario E: Slurry Pipeline transport

To maintain some realism, an assumption was made that coal which was previously delivered by barge or rail (which is currently true of the TECO plants at Big Bend and Gannon) would continue to use the same mode choice.

The year 1990 was used as a model period since it replicates previous analysis performed by ANL from information provided by the Florida Electric Power Coordinating Group and the Florida Public Service Commission. Considering the lead time necessry to convert their power plants from oil to coal use which includes the construction of on-site coal handling and storage facilities, boiler alteration, and, if necessary, electrostatic percipitator installation, it is doubtful that any of the candidate plants will have converted to coal-fired generation before 1990.

5.1 ALL BARGE

In order to determine the volume of coal-related barge traffic in the Tampa Bay Region, it will be first necessary to determine the number of barges which carry coal, currently, as well as the amount carried. Next, using projected 1990 coal demands determined by dispatch analysis conducted by Science Applications, Inc., for the U.S. Department of Energy (Fuels Conversion Division), an estimate of coal barge traffic can be estimated.

Currently, an estimated 4000×10^{3} short tons of coal are consumed annually by Tampa Electric Company (TECO) at its Big Bend and Gannon electric generating plants. If all of this coal was delivered by barge and each barge carried the design capacity of 1500 tons (1.5 x 103) an estimated 2667 loaded barge trips would be generated on an annual basis (see Table 5.5.A). This estimate does not include trips generated to provide stockpiled coal which is a necessary contingency.

TABLE 5.1.A

COAL CONSUMPTION (10^3 TONS)

Utility	Plant	Year 1982	Year 1990	Increase
FPC	Anclote	0	1488	1488
	Bartow	0	551	551
TECO	Big Bend	2800	3542	742
	Gannon	1200	1596	396
FPL	Manatee	0	2116	2116
TOTAL		4000	9293	5293

NOTE: Plants which are conversion candidates are indicated with "O" under coal consumption.

SOURCE: 1. Science Applications, Inc. (SAI) for U.S. Department of Energy.

2. Tampa Electric Company

3. <u>TYSP</u>

Depending upon final destination the barges may not carry the designed capacity, but may be loaded with 1200 tons based on channel depths. If this was practiced completely, the resulting barge trip volume generated by TECO demand would be increased to 3334 on an annual basis.

Currently, the estimated four million short tons of coal which is consumed by the Gannon and Big Bend plants is transported via a combination of rail. However, TECO is shifting the delivery mode emphasis from rail to barge. Assuming that the barges are loaded to the design capacity, the two power plants generate a need for 888 barge trips. Once again no consideration is given for contingency stockpiling.

Using this same analysis of an all barge delivery scheme, a total of approximately 6200 barges would be necessary to satiate the projected 1990 coal demands. Assuming that the increased coal demand and the existing barge-transported coal ((5293 + 1333) x 10^3 tons) were to be shipped via barge mode, the projected annual barge trips would be approximately 4420. On an average monthly basis, this would amount to approximately 370 barges with a combined load of 552,500 short tons. In analyzing cargo reports from the Tampa Port Authority (TPA), it was determined that in a one year period (December 1982 to November 1983) there were 1143 barge trips in the harbor, this figure includes all barge traffic and not only coal oriented traffic. Thus, for additional barge traffic which will be necessary to accommodate the increased demand for coal (approximately 365) will vastly increase the total barge traffic in the Tampa Bay Area by 23 percent.

Currently coal transported by barge into Tampa Bay comprises 10 percent of the TPA's total tonnage and approximately 35 percent of the total tonnage conveyed by the combined barge use. While most of the information presented above considerations rive barge capacities (1500 ton/vessel), coal shipment by barge into Tampa Bay is currently accomplished by large 22,000 ton vessels. In fact the industry tendency is moving toward the much larger (up to 60-70,000 ton vessels). Assuming that the existing 22,000 ton vessels are used to transport coal to shoreline CHSFs. Barge traffic could vary from 365 vessels (High Demand/All Barge) to 204 vessels (Low Demand/Pipeline Use). It should be noted that coal barges would replace oil barges on practically a one-to-one basis. (See Table 5.6.B)

TABLE 5.1.B

PORT OF TAMPA
COAL AND BARGE IMPACTS BY MONTH BY TONNAGE
DECEMBER 1982 - NOVEMBER 1983

Total	Tonnage	Coal Tonnage	(%) A	(%) B	Barge Tonnage	(%) C	Total Barges
12/82	2,755,445	349,040	(12.7)	(57.3)	609,124	(22.1)	76
1/83	2,694,763	325,262	(12.1)	(49.2)	661,279	(24.5)	80
2/83	2,429,393	231,463	(9.5)	(35.1)	660,108	(27.2)	80
3/83	2,836,240	238,150	(8.4)	(33.6)	709,113	(25.0)	84
4/83	2,835,316	195,000	(6.9)	(25.8)	756,800	(26.7)	87
5/83	3,035,777	255,090	(8.4)	(29.2)	872,581	(28.7)	111
6/83	2,594,634	152,670	(5.9)	(19.8)	771,426	(29.7)	94
7/83	2,932,702	340,044	(11.6)	(38.2)	891,200	(30.4)	124
8/83	2,613,070	388,162	(14.9)	(41.4)	937,616	(35.9)	109
9/83	2,899,283	351,280	(12.1)	(39.1)	898,545	(31.0)	99
10/83	2,696,683	232,345	(8.6)	(24.5)	950,056	(35.2)	114
11/83	2,758.537	277,042	(10.0)	(25.9)	770,910	(27.9)	85
TOTAL	33,081,843	3,336,367	(10.1)	(35.2)	9,488,758	(28.7)	1,143

NOTE: A Coal Tonnage % of Total Tonnage
B Coal Tonnage % of Barge Tonnage
C Barge Tonnage % of Total Tonnage

SOURCE: Tampa Port Authority

TABLE 5.1.C

PORT MANATEE
COAL AND BARGE IMPACTS
OCTOBER 1982 - SEPTEMBER 1983

Total Tonnage	Coal Tonnage	Barge Tonnage	Total Barges
5,744,331	0	1,995,275 *	455

Note: * Estimated by registered gross tons categories
Source: Manatee County Port Authority

5.2 MIXED MODE (2 BARGE:1RAIL)

From a market realist view, coal consumers will probably attempt to locate either handling facilities, if separate from the final destination, or power plants on sites which are accessible vice rail and water modes. Such logic maximizes both source of fuel options due to reduction in transshipment points as well as final delivery options, due to transport-unit-cost considerations. Finally, as Table 2.6.A illustrates along with other references, Bartow, Gannon and Big Bend are all located on the water and therefore viable barge mode delivery candidates. However other power stations are located on or near railroad lines or sidings. When the fact that the transport mode decisions are made by three different firms is also considered the only logical path is one of a mixed-mode delivery system.

The two:one mode scenario assumes that each firm will make delivery decisions for each plant and accept coal from a single mode (barge or rail) as its primary means of coal transport. A further assumption was made that currently coal-fired units would continue to receive the fossil-fuel by the same mode. Therefore only that coal which is destined for the conversion candidate units was considered. The coal measured in short tons and assigned to hopper cars or barges was added to similar units of the same mode to determine the total unit amount by end delivery choice. Table 5.5.A indicates what the projected impact would be for total conversion of all candidate units, plus existing coal-fired units if this conversion occurred by 1990.

5.3 MIXED MODE (1 BARGE:2 RAIL)

In this end delivery scenario, the logic is similar to the previous mixed mode discussion, but the favored mode is rail. Table 5.5.A indicates that in this scenario, rail-delivered coal would increase by practically 132 percent over the highest barge use estimate and 40 percent over a delivery mixture favoring barge over rail. Based on the assumption that the rail-favored mixed mode scenario evolved, the perceived impact would be an increase of 60740-80 ton open hopper rail cars entering the Tampa Bay region on an annual basis. Assuming a 75-car unit train this increase translates to an additional 16 unit trains each week.

5.4 ALL RAIL SCENARIO

In the study conducted for U.S.D.O.E., it was generally concluded that coal movements from central Appalachia "...offer direct rail movements at reasonable prices to the generating stations at ...Anclote and Manatee." (Tobin, et al, 1983). The Tampa Bay Area in particular and Florida, in general, are well served by Seaboard System Railroad which is combined with other systems located in the coal producing regional (Chesapeake and Ohio, Baltimore and Ohio, and the Western Maryland) to form the Chessie System (CSX) Corporation. The merger of these various regional systems has served to make CSX the largest rail system which originates coal traffic in the nation. For instance, practically half of all the coal transported by rail in 1981 (approximately 250 million tons) was transported by the CSX railroad according to a statement issued by the CSX Corporation.

Practically all the coal conversion candidates and the new or proposed electrical generation plants are situated on a railroad line. All of the new, proposed, or candidate plants (with the exception of Anclote and Bartow) are located on rail lines owned by the Seaboard System Railroad. In a recent communication with the New Port Richey-West Pasco County Metropolitan Planning Organization (January 11, 1984) it was learned that there are no known plans to extend rail service to the Anclote facility. The Bartow facility is located on Weedon Island in the northeast St. Petersburg area. The closest existing rail line is approximately five miles from the site. However, both of these facilities are located along the shoreline thus making them more attractive to a barge delivery option.

Based on the assumption that one pound of coal equals 12,000 Btu, projected demand for annual consumption of coal for 1990 was derived for each of the existing, proposed, and conversion candidate plants. To remain consistent with this scenario format, it is assumed that all coal will be delivered via rail. Please note, however, that this will present a major outlay of development capital to construct spur facilities to Anclote and Bartow.

The projected increase in coal for consumption by the electric generation plants will be 5,293,000 tons per annum (1990). Based on the assumption that a rail car can transport 80 tons of coal and that these open-top hopper cars are combined into a dedicated unit train of 75 cars, there will be a generated trip demand of 66,170 cars or approximately 880 unit trains annually. This is an extremely significant increase in rail traffic.

Unit trains can travel as much as 800 miles per day based on information provided by the Office of Technology Assessment. In a study conducted by the Argorne National Laboratory (ANL) for U.S.D.O.E., coal supply areas based on availability by sulfur content were determined. To provide coal containing an acceptable sulfur content, unit trains may need to travel as much as three days.

Currently, the existing coal burning plants (Gannon and Big Bend) receive approximately two-thirds of their coal via rail. This amounts to approximately 2.7 million tons. There is a significant mode shift away from rail to barge transport, over time, TECO officials anticipate an 80:20 split favoring barge delivery. The method of delivery is via 80 ton hopper cars combined in a unit train. Thus, the plants generate a demand for 33,750 hopper cars annually. Assuming that these cars are aggregated into 75-car unit trains, the plants accommodate 450 unit trains annually or approximately six trains every five days. Using a similar logic developed in the ALL BARGE (Scenario A) discussion, these 450 unit trains would be augmented by an additional 880 such conveyances for a total of 1330. If TECO decided to "put its eggs into a single basket" and abandon its existing large delivery system which delivers approximately 1.3 million tons per annum, it would result in an additional 16625 hopper cars combined to form 222 unit trains. Thus, the total number of unit trains entering the Tampa Bay Area would increase from approximately 450 unit trains annually to approximately 1550 or an increase of 345 percent.

TABLE 5.4.A

SUPPLY DISTANCES FOR ELECTRIC GENERATION STATIONS

Station	Sulfur[a]	Distance
Anclote	2	1675
	2	801
	2	1271
Bartow	3	1603
	3	1121
Big Bend	5	1303
	5	1373
	5	1398
Gannon	3	833
	3	1303
	3	1398
Manatee	2	777
	2	914

SOURCE: Argonne National Laboratory, 1983

NOTE:[a] Sulfur refers to Percentage of Sulfur Content

Category	Sulfur Content
1	0.0 - 0.64%
2	0.65 - 1.04%
3	1.05 - 1.84%
4	1.85 - 2.24%
5	2.25 - 3.04%
6	3.05+

This increase in rail transport must be considered along with increases in other industrial uses of the rail made. Phosphate rock and, more significantly phosphate chemical shipments are expected to increase with the latter form anticipated to account for an 80 percent increase by 1990.

According to studies conducted by Wilbur Smith and Associates (June 1980), rail shipments of phosphate products through the region and into the Port of Tampa are estimated to total 26, 300,000 tons with an additional eight million tons shipped on interior rail routes north. Further, phosphate rock shipments via rail mode from their mine origin to chemical processing plants is expected to increase to 27 million tons. The impacts discussed above will undoubtedly fluctuate due to changes in world demand for chemical fertilizers.

The rail cars are similar to those used to transport coal (70-100 ton hopper cars). Normally these cars are joined into unit trains which comprise 65 to 100 hopper cars in a single pull. Similar to coal and other bulk cargoes, the phosphate industry is altering its preference to the newer 100-ton hopper car as the existing 70 tons cars are being phased out.

TABLE 5.4.B

PHOSPHATE RAIL CAR TERMINATIONS

Location	Cars	Tons (10^3)
Eastern	77,000	6,600
Rockport	86,000	6,600
Sutton	71,000	5,000
East Tampa	9,000	400
Big Bend	25,000	2,000
Manatee	3,800*	167
TOTAL	271,800	20,767

SOURCE: Wilbur Smith and Associates, June 1980
NOTE: *Estimate

Using the Wilbur Smith (WSA) study and coordinating closely with CSX officials and representatives of the affected metropolitan planning organizations, various crossings can be studied to determine the impacts of increased rail activity. The WSA study was conducted for the Florida Department of Transportation (FDOT) to assess the impact of increased phosphate product movement through the West Central Florida Regional rail network.

5.5 SLURRY PIPELINE SCENARIO

After reviewing the previously discussed scenarios it becomes apparent that the dramatic increase in coal use and subsequent transportation system impacts, other alternatives should be considered as to their feasibility to reduce potential system deficiencies. One such alternative is a slurry pipeline.

In the study conducted by the ANL, it was determined that 34 percent (12.2 million Tons per year) could be delivered via this transport mode. This system could replace two-thirds of the coal delivered by rail and one-third of the barge shipments based on the maximum rail use scenario, or one-fourth of the rail delivery, one-fourth of the inland water delivery and one-half of the ocean vessel delivery in the maximum water delivery scenario. Even though the scenarios developed for this study are somewhat different than those calculated by ANL.

The pipeline transports a 50-50 mixture of coal and a fluid, either water or oil mixture (CWM or COM, respectively). While the use of COM may be easier to accomplish with less retrofit of existing boilers of conversion candidates, studies performed by FPL in their Sanford facility indicates that no savings in fuel costs or delivery costs are actualized.

Several companies, nationwide, are developing studies to retrofit existing plants to accommodate the burning of CWM. According to information provided to ANL for their study it was stated that "...only 'modest modifications' would be required to burn CWM's instead of oil if the CWM contained no more than two to three percent ash and the coal portion of the mixture had a heating value of 14,000 to 15,000 Btu/lb." Two problems do exist however, concerning the long-term storage of CWM which will require a reagitation of the mixture and the development of erosion-resistent burners.

A third concern is the disposition of the residue resulting from the combustion of CWM. Quoting from a Southwest Florida Water Management District proposal:

> While considerable research has been carried out on the metallic ions present in water exposed to coal, relatively little is known about the organic compounds which are extracted or leached from the coal. Essentially no information concerning the inorganic or organic species present in coal slurry transport water is available. However, sufficient information is available from studies with water from coal conversion processes to indicate that some of the toxic compounds (e.g., polycyclic aromatics) are in such waters. These, together with metallic ions, constitute a serious hazard to the quality of water and imply environmental pollution of growing dimensions. In a full scale effort, it would be incumbent upon the investigators to identify many of these compounds for correlation with the bioassay studies.

Based on information available from various sources, there are potential plans to build coal slurry pipelines which will extend 1200 miles and carry up to 45,000 thousand short tons plus a comparable amount of water per year.

While such a system may significantly reduce imports on the rail and water transportation system, other problems must be rectified prior to the commitment to such a scenario.

TABLE 5.5.A

SCENARIO IMPACT COMPARISON TABLE

	BARGE		RAIL		PIPELINE
	Units	Tons(10^3)	Units	Tons(10^3)	Tons(10^3)
SCENARIO A: All Barge	4420 (305)	6626	33340	2667	0
SCENARIO B: 2/3 Barge- 1/3 Rail	3240 (225)	4858	55375	4430	0
SCENARIO C: 1/3 Barge- 2.3 Rail	2070 (145)	3096	77405	6192	0
SCENARIO D: All Rail	890 (65)	1333	99500	7960	0
SCENARIO E: Pipeline	890 (65)	1333	60000	4800	3160

SOURCE: 1. Ten Year Site Plans
2. Argonne National Laboratory, Florida Statewide Coal Conversion Study, 1983

NOTE: 1. Amounts may vary due to rounding.

2. 1500 ton (22,000 Ton) Barge units.

5.6 DEMAND/MODE MATRIX

The Regional Coal Study Advisory Committee decided that the five scenarios (rail, barge, mixed-mode and slurry pipeline) should be developed into a matrix considering various levels of demand for coal. Essentially, three levels of demand will be generated consisting of:

1. HIGH DEMAND: Conversion of all three candidate plants, plus increased demand by TECO for Gannon and Big Bend.

2. MEDIUM DEMAND: Conversion of two candidate plants, plus increased demand by TECO.

3. LOW DEMAND: Conversion of one candidate plant, plus increased demand by TECO.

Thus, the DEMAND/MODE matrix will consist of a 3x5 cell analysis which should quantify as many as 15 possible scenarios. Analysis of each scenario will afford the greatest possible assessment of potential surface transportation network impacts.

In order to determine the amount of coal which will be transported, it is first necessary to make some assumptions. Among these assumptions are the following:

1. The price of coal will remain constant or increase very slightly in relation to the price of oil. As price of oil increases, the price of coal will probably increase keeping the gap at a similar distance.

2. There will be no substantive change in federal, state or local environmental standards.

3. Availability of rolling stock or barges will not be an obstacle.

4. The utility companies will not convert a plant which is economically infeasible due to boiler derating.

5. Conservation and coal-by-wire programs will not satiate increasing consumer demand for electricity, this is primarily due to population increase and technology shift.

Based on these assumptions the HIGH DEMAND will consider conversion of the FPC plants at Anclote (Pasco County) and Bartow (Pinellas County), the FP&L plant at Manatee (Manatee County), and the increased demand for TECO plants Big Bend and Gannon (Hillsborough County).

The MEDIUM DEMAND is based on the assumption that only two plants will convert. In order to compute the amount of coal needed for transportation, two conversion candidates are being considered. They are the Bartow and Anclote plants. The Manatee plant was eliminated from this component due to a Manatee County environmental ordinance which restricts the burning of coal (Article I, Section 4) in the County.

The LOW DEMAND is based on the assumption that only one plant will convert. In addition to the deletion of the Manatee plant which is discussed above, the Anclote plant is very remote from a rail siding and extensive dredge and fill operations would be necesary to accomodate barge delivery. Further, a very significant boiler derating would result from coal conversion. Thus, the FPC Bartow Plant which has boilers originally designed for coal firing and has a dock and existing channel which serves oil barges was selected for this component.

In both the MEDIUM and LOW DEMAND components, it was assumed that TECO coal demand increases as expressed in the Ten Year Site Plans would be included in the total demand tonnage.

TABLE 5.6.A

DEMAND TOTALS 1990

	HIGH	MEDIUM	LOW
Anclote	1488	1488	--
Bartow	551	551	551
Big Bend	4177	4177	4177
Gannon	1434	1434	1434
Manatee	1496	-	-
Total	9146	7650	6162

Source: 1. Science Applications, Inc. (SAI) for U.S. Department of Energy
2. TECO
3. FPC, TYSP
4. FP&L, TYSP

Note: 10^3 Coal

TABLE 5.6.B

DEMAND/MODE MATRIX

	SCENARIO A					SCENARIO B					SCENARIO C				
DEMAND	BARGE UNITS	BARGE TONS	RAIL UNITS	RAIL TONS	PIPELINE TONS	BARGE UNITS	BARGE TONS	RAIL UNITS	RAIL TONS	PIPELINE TONS	BARGE UNITS	BARGE TONS	RAIL UNITS	RAIL TONS	PIPELINE TONS
HIGH	364	8024	14965	1122	0	311	6847	28740	2299	0	258	5666	43500	3480	0
MEDIUM	300	6528	14965	1122	0	270	5849	22525	1802	0	235	5169	31025	2482	0
LOW	230	5040	14965	1122	0	221	4857	16315	1305	0	213	4672	18625	1490	0

Note: Tons x 10^3

Sources: 1. TECO, TYSP
2. FP&L, TYSP
3. FPC, TYSP
4. ANL, Florida Statewide Coal Conversion Study, 1983

SCENARIO D					SCENARIO E				
BARGE UNITS	BARGE TONS	RAIL UNITS	RAIL TONS	PIPELINE TONS	BARGE UNITS	BARGE TONS	RAIL UNITS	RAIL TONS	PIPELINE TONS
204	4489	58215	4657	0	204	4489	28790	2303	2354
294	4489	39515	3161	0	204	4489	22525	1802	1360
204	4489	20915	1673	0	204	4489	16315	1305	368

CHAPTER SIX

IMPROVEMENTS ANALYSIS

6.1 WATER TRANSPORT IMPROVEMENTS

Based on various scenarios, barge traffic may increase drastically or minimally, depending upon the number of units which convert, their location, and their previous fuel delivery mode. Currently barge traffic is approximately 1600 units per year with nearly 70 percent of that traffic terminating in the Port of Tampa and the balance docking in Port Manatee. The variation in barge traffic operating in the channels of Tampa Bay could vary from 364 to 204 per annum or from practically one additional trip per day to approximately four per week (see Table 5.6.B).

Therefore, with the possible exception of channel deepening activities associated with the Anclote plant, which would be highly unlikely due to other difficulties involved in conversion of the two units at that station, it does not appear that improvements to existing channels or dredging of additional ones will be necessary.

6.2 RAIL TRANSPORT IMPROVEMENTS

Currently, approximately 40 percent of all coal consumed in the Tampa Bay Area is delivered by unit train (see Table 3.2.1.B). It is obvious that there will be increases in the amount of coal transported by rail, however that amount will vary based on the number of unit conversions and additions, location of the units and prior committments for delivery modes. The number of unit trains could vary from 585 to 150 per year or from eight trains to two trains every five days. (See Table 5.6.B)

Increased rail traffic impacts not only the capacity of the railroad network but also the highway network due to the plethora of at-grade track crossings. Rail/auto conflicts usually engender vehicle (and therefore person delays), and collision potential. In fact, freight and passenger rail operations in the west central Florida area have been plagued by grade crossing accidents and has been reputed to have one of the worst records in the nation (Wilbur Smith, 1980).

The project increase in coal tonnage carried by rail will result in the need to install and maintain 115 pound rails on the lines which serve coal delivery trains. Along lines which serve both coal and phosphate, the major bulk cargo moved by rail, the trackage should be composed of 132 pound rail since combined projections of phosphate and coal tonnage exceed 11 tons per annum.

Using railroad system maps prepared by the Florida Department of Transportation, several at-grade crossings were identified. Railroad crossings of arterial and collector roadways were the only ones considered; this is based on the probability of greater traffic volumes occurring at any given time. The following at-grade crossings should be analyzed for potentially unacceptable vehicle and person delay times.

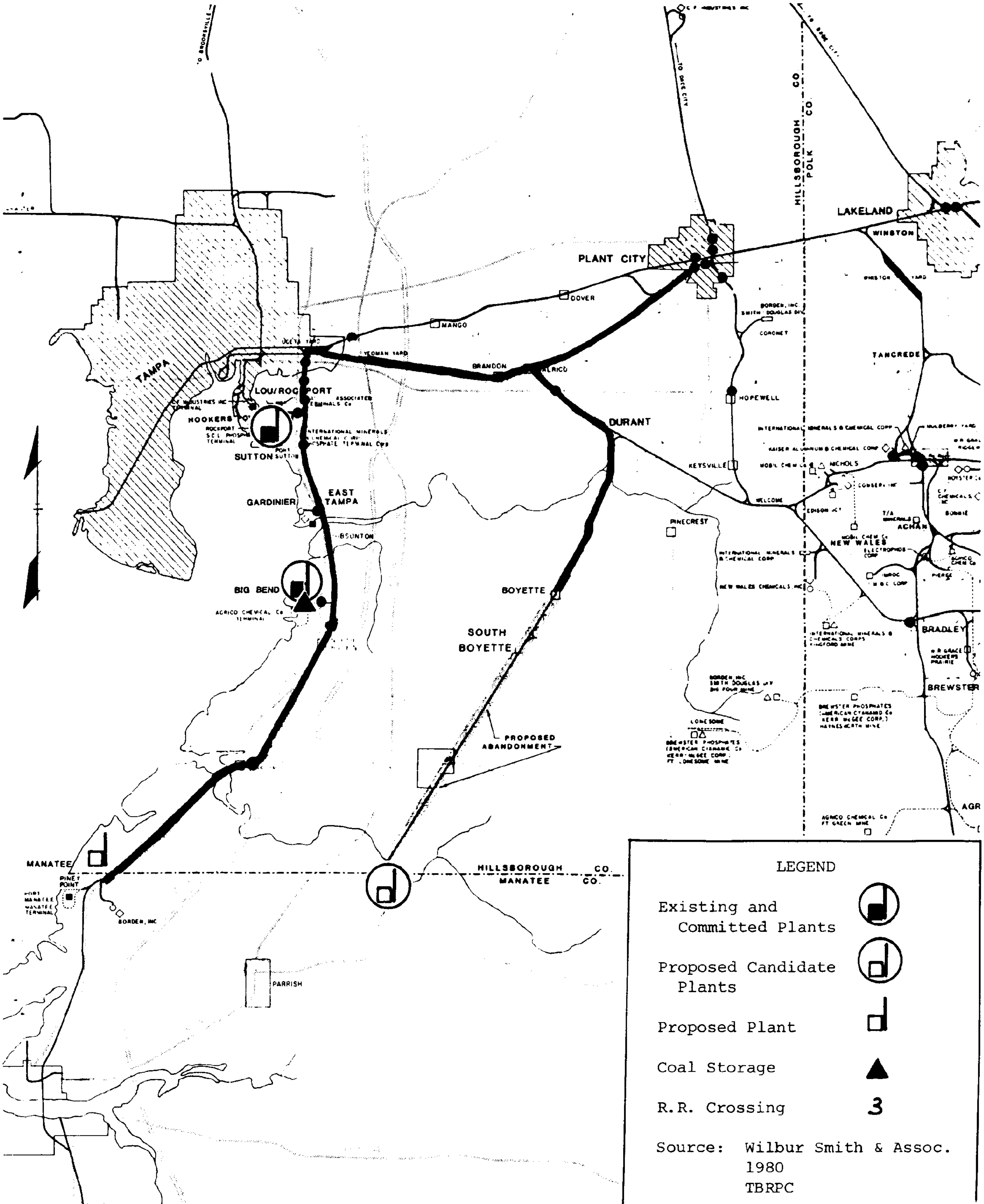
TABLE 6.2.A

RECOMMENDED RAILROAD CROSSINGS FOR
VEHICLE AND PERSON DELAY ANALYSIS

Road	Facility Type	Track
County Line Rd.	Rural Collector	S/801
Knights-Griffin Rd (CR 582)	Rural Collector	S/801
CR 580	Rural Collector	S/801
Forbes Rd/SR 574	Rural Collector/Arterial	A/301
McIntosh Rd/SR 574	Rural Collector/Arterial	A/301
Lumsden Ave-Causeway Blvd. (CR 676)	Collector	AZA/340
Lou-Rockport - Sutton Lead	Arterial	AZA/340
Madison Ave (CR 676A)	Collector	AZA/340
US 41	Arterial	AZA/340
Big Bend Lead - US 41	Arterial	AZA/340
SR 39A (Alexander St.)	Arterial	S/801
SR 39 (Collins St.)	Arterial	S/801
US 92 E.B. (E. Reynolds St.)	Arterial	S/801
US 92 W.B. (E. Baker St.)	Arterial	S/801
CR 574A (Brook St.)	Collector	S/801
CR 672	Collector	SW/803
SR 674	Collector	SW/803
Lithia-Pinecrest (CR 640)	Collector	SW/803
SR 60	Arterial	SZ/802
	Collector	SZ/802

Source: Florida Department of Transportation
Tampa Bay Regional Planning Council

FIGURE 6.2.A
Existing and Proposed Routing of Coal Unit Trains



If an at grade crossing occurs by a 100-100 ton unit train at 20 miles per hour and the crossing is equipped with an audible alarm and barriers vehicles approaching the crossing will be delayed approximately four minutes per unit train. A single train would, at a peak hour could cause a delay of up to 112 vehicles or, based on default value vehicle occupancy rates, 135 persons at four minutes each or 9 hours of time on a two lane undivided arterial On a four lane divided arterial, the same train would create delays for an estimated 225 vehicles or up to 18 hours of total person delays.

In addition to person delays, there are also losses in motor fuel efficiencies based on idling engines and greater noxious air emissions. Air emissions loadings will be of particular concern in Hillsborough County and to Pinellas County due to the presence of a non-attainment area for total suspended particulates, (Hillsborough) and ozone (Hillsborough and Pinellas).

Therefore, at crossings which experience significantly high vehicle and person delay times, grade-separated rail crosings should be considered and should enter the appropriate transportation improvement program. At a minimum, the need for grade separated interchanges should be analyzed at all two and four lane arterial facilities.

CHAPTER SEVEN

REGIONAL MANAGEMENT PLAN

7.1 INTERAGENCY REVIEW

The stated objectives of the Coal Conversion Impact Study (CCIS) are namely, (1. To develop a better public understanding of and more effective participation in the decision-making process regarding the increasing use of coal, (2. To coordinate with local, state and federal agencies to promote orderly coal conversion of new construction of power plants in the region, and (3. To formulate recommendations aimed at mitigating and minimizing impacts associated with the increasing use of coal as a regional energy source on the region's transportation network can only be accomplished through an intergrated effect of public and private sector agencies.

As a basic working group to assist the Council in conducting the CCIS, the Regional Coal Study Advisory Committee (RCSAC) was established. The RCSAC is composed of representatives from coal users (both existing and potential) coal transporters, and local and state regulatory and planning agencies. A list of agencies represented on the RCSAC is provided below.

TABLE 7.1.A

AGENCIES REPRESENTED ON THE
REGIONAL COAL STUDY ADVISORY COMMITTEE

Name	Type
City of Tampa	Local Government
City of Dunedin	Local Government
City of Clearwater	Local Government
City of St. Petersburg	Local Government
Hillsborough County	Local Government
Pinellas County	Local Government
Pasco County	Local Government
Manatee County	Local Government
Tampa Port Authority	Port Operations
Manatee County Port Authority	Port Operations
Port Sutton	Port Operations
Governor's Energy Office	State Government
Florida Department of Transportation	State Government
Florida Department of Environmental Regulation	State Government
Florida Department of Community Affairs	State Government
Tampa Electric Company	Coal User
Florida Power Corporation	Potential Coal User
Florida Power & Light Company	Potential Coal User
Florida Electric Power Coordinating Group	Utility Advocate
Florida Phosphate Council	Industry Advocate
Florida Petroleum Council	Industry Advocate
Mangrove System, Inc.	Environmental Industry
Meisner Industries, Inc.	Transport Advocate

AGENCIES REPRESENTED ON THE REGIONAL COAL STUDY ADVISORY COMMITTEE (CONTINUED)

Seaboard Systems Railroad	Transport Advocate
Tampa Bay Sanctuaries	Environmental Advocate
Manasota-88	Environmental Advocate
Mote Marine Laboratories	Environmental Industry
University of South Florida	Public Education
U.S. Coast Guard	Transportation Safety

Source: TBRPC, 1984

By using the RCSAC as well as standing committees of the Council which review and provide comment for transportation and Tampa Bay issues, a comprehensive reviews which feature a cross-fertilization of ideas and perceived impacts is possible.

7.2 PUBLIC PARTICIPATION

Public participation has become an essential component of the planning process. The Tampa Bay Regional Planning Council through its committees and council activities does provide a forum for public discussion. Further policy recommendations and study documentations are available to the public at any time.

The committee and council forum established by TBRPC essentially augments other public input points such as local government reviews of proposed power plant siting, intergovernmental coordination and review of environmental impact statements, Ten Year Site Plans, and electrical power plant site certification, report preparation by the Public Service Commission, the water management district with jurisdiction and other agencies, as appropriate.

7.3 EXISTING POLICIES

The Tampa Bay Regional Planning Council, a voluntary association of governments, established pursuant to Chapter 160 of the Florida Statutes, has adopted a growth policy statement, <u>Future of the Region</u>. Using this collection of issue-oriented policies, the Council reviews development activities and provides comment relative to the consistency of development proposals to these adopted policies.

The Future of the Region provides growth policies to guide reviews of development proposals and their probable impacts to the people, environment, and capital facilties of the region. Specifically the document offers policies relative to:

Land Use
Resources (Air, Water, Energy, Vegetation, etc)
Transportation
Housing and Community Development
Social Services
Economics
Governmental Relations

To this end, the following existing policies are appropriate for use in subsequent review of coal associated activity.

2.0 Land Use

It shall be Council policy to preserve and restore our land's natural beauty and functional uses. Development of land areas should be designed to minimize destruction of natural heritage and promote harmony between the man-made and natural life support systems inclusive of land, water and air resources.

2.1 It shall be the policy of the Council to encourage open space as a means of providing the population with visual relief from the urban environments as well as a menas of preserving and conserving special lands. Aside from broad expanses at the urbans fringe, such as green areas, open space should be included within urban areas, especially near high density areas.

2.4 It shall be the policy of the Council to ensure that industrial land uses are planned to meet the needs of the resident population in areas most suitable with respect to the protection of environmental and natural resources, energy efficiency, economic development objectives and the orderly extension and expansion of public facilities and services.

2.401 Industrial land uses should be located in areas which have adequate transportation services for needed labor supply, materials and product shipment.

2.402 Industrial land uses should be encouraged and protected where they will be compatible with surrounding land uses.

3.0 Resources

3.3 It shall be the policy of the Council to promote the national energy goals of reducing U.S. dependence on foreign oil, extending the useful life of non-renewable energy reserves, and furthering research into ways of generating power. The Council, through its planning, research and development review programs, shall promote and work toward an energy-sufficient and efficient human environment where housing, transportation, government, commerce and industry are all capable of meeting the present and future needs of the Tampa Bay

Region. In addition, the Council shall strive to minimize adverse energy impacts on all facets of the region's economic and social environment.

3.302 Transportation Sector - The most energy efficient means economically feasible shall be utilized in the construction, maintenance, and operation of the region's transportation systems. Life-cycle costing (to include operation and maintenance costs) shall be utilized in evaluating energy conservation effectiveness.

3.6 It shall be the policy of the Council to recognize the region's coastal zone as a unique resource upon which constant and competing demands are being made in terms of its vital environmental, economic, social and cultural significance to the health, safety and welfare of the region's residents. Furthermore, it shall be the policy of the Council to encourage and promote sound coastal management to ensure that maximum long term benefits are attained in the use of the coastal zone by and for the region's residents.

4.0 Transportation

The Council shall offer leadership in the development of a balanced transportation system (inclusive of all modes) that can move both people and goods in an effective, safe, and efficient manner to meet the present and future transportation needs of the reigon. Transportation development is viewed as an integral part of the total comprehensive planning process of the region and should be used as a tool for shaping future growth and implementing approved local and regional plans. Priority is given to maintenance and reconstruction of existing facilities whenever possible.

4.109 Transportation service that is the optimum balance between the costs and the movement of people and goods with respect to all modal alternatives.

4.112 Joint-use concepts among modes of transportation and between transportation facilities and related land uses.

4.202 Highways - It shall be the policy of the Council that the region's highway system be planned, developed and maintained to provide and preserve a stable traffic flow.

4.205 Ports and Waterways - It shall be the policy of the Council to plan for and support an efficient system of ports and waterways designed to serve the goods movement, passenger and recreation water transportation needs of the Tampa Bay Region:

(b) Port Facilities and waterways should be developed to assure an optimum balance between economic costs and benefits and environmental and social costs.

(c) Coordination and development of ground transportation facilities that efficiently serve port facilities are encouraged.

7.0 Economics

7.1 It shall be the policy of the Council to provide leadership in developing a stable and diversified economic base.

7.101 (c) Adequate public facilities, energy, and transportation services to serve new and existing industries and businesses should be ensured.

8.0 Governmental Relations

It shall be the policy of the Council to encourage an integrated approach to the implementation of this growth policy which will involve the active participation and coordination of multiple interests within the community.

7.4 COAL TRANSPORTATION POLICY RECOMMENDATIONS

Based on the data gathered for this study, it is the opinion of the TBRPC that the regional surface transportation network should be able to accomodate increased barge and rail traffic which would be generated by the consumption of greater amounts of steam coal by electric generating stations, based on the Low Demand Scenario. However, in addition to existing adopted policies listed earlier in this report, the following policies should be considered during any subsequent review of coal associated activity.

1. Coal entering into and travelling through the area by rail should be routed on 115 pound or greater rail.

2. Coal unit trains should be routed away from residential areas to minimize, deleterious impacts of fugitive dust.

3. Prior to any significant increase in coal consumption safety and vehicle delay studies should be conducted at all at-grade crossings of arterial and urban and rural collector facilities along the selected unit train route. These studies should be included in the site certification process or during the conversion of an existing generating unit to coal fired generation.

4. Feasibility of coal slurry pipeline transport should be determined prior to any termination of coal conversion status where coal delivery via barge or rail is inappropriate due to over-riding environmental or social impacts.

5. Transportation of coal should be accomplished by the most direct means while avoiding densly populated urban areas whenever possible.

6. While in transport, coal should be handled in a fashion which will minimize fugitive dust emisison.

7. Due to high transport costs and potential for road surface and subgrade deterioration, local shipment by truck should be discouraged on public highways and for any distance.

8. Transport of coal should be scheduled so that it will not impede peak period traffic.

9. In addition to transport of coal, the impacts related to the transport of ash residue and sludge from flue gas desulfurization systems should be analyzed.

(State Regulatory Amendments)

1. Section 403.507 (2) F.S. should be amended to require a study of the adequacy of the existing transportation system (barge, rail, or highway) to accomodate the delivery of coal by the selected primary and secondary (if applicable) mode.

2. Section 403.506(2), F.S., should be amended to require study of the transportation system adequacy to accomodate the proposed delivery mode choice if that choice differs from the current delivery mode. The adequacy of the selected system to accomodate the increased activity generated by the fuel delivery mode choice should become a condition of certification.

7.5 COAL HANDLING AND STORAGE FACILITIES LOCATION AND DESIGN POLICY RECOMMENDATIONS

Based on the information gathered for this study, it is the opinion of the TBRPC that the existing coal handling and storage facilities (CHSF) are adequate to accomodate the current demand for the fossil fuel. In the event that existing oil-fired plants are converted or proposals for new coal-fired plants are reviewed, in addition to the adopted Council policies, the following policies should be considered during any subsequent review or study of a coal associated activity.

1. Coal handling and storage facilities (CHSF) should be located in <u>Heavy Industry</u> or other approved zoning districts which are consistent with an adopted land use plan.

2. The CHSF should be located within a close distance to barge and/or rail facilities to reduce transport costs through trans-shipment.

3. Location of a CHSF should be in an area which will reduce transportation conflicts and not exacerbate surface transportation system deficiences.

4. The site for a CHSF should be of sufficient area to accomodate growth of the stockpile while maintaining an appropriate buffer from adjacent land uses.

5. Local governments in whose jurisdictions coal-fired plants or conversion candidate plants ae located, should amend their development regulations so that CHSFs can be sited as necessary.

6. The CHSF should be designed to control and abate fugitive dust emissions from the coal stack as well as during transport and handling.

7. The CHSF should be designed to prevent leaching into ground waters or run-off into surface water bodies of coal contaminants, especially metals.

8. Disposal of coal combustion by-products should be performed consistent with the provisions of Section 403.707, F.S. and Chapter 17-7.12. F.A.C., or their successor amendments and regulations.

9. In locations which are designated non-attainment areas due to violations of the State of Florida Air Quality Standards for particulate matter, a new or modified CSHF should be reviewed in accordance with Chapter 17-2.510, FAC.

BIBLIOGRAPHY

Allman, William P., "The Northeast Utility Coal Transportation Challenge," Transportation Quarterly, vol 38, nr 3, July 1984.

Bureau of City Planning, City of Tampa, Tampa Comprehensive Plan 2000, Tampa, FL., 1977.

Condolios, Elie, Transport of Materials in Bulk or Containers by Pipeline, Department of Economic and Social Affairs, United Nations, New York, NY., 1966.

Eastman, Samuel E., "Fuel Efficiency in Freight Transportation, "Transportation Research Record Nr. 824, Transportation Research Board, Washington, D.C., 1981.

Eastman, Samuel E., "Selected Productivity Comparisons in Surface Freight Transportation: Inland Water, Rail, and Truck, "Transportation Research Record Nr. 880, Transportation Research Board, Washington, D.C., 1982.

Economic Regulatory Administration, Conversion of Florida Electric Power Plants from Oil to Coal Burning: Engineering Environmetal, and Economic Feasibility Study of 14 Florida Generating Stations, Draft Final Report, U.S. Department of Energy, Washington, D.C., April 1983.

Family Lines Rail System, Louisville and Nashville and Clinch Field Railroads Coal Mine Directory and Coal Transportation Guide, Seaboard Systems Railroad, Jacksonville, FL., 1981.

Florida Power Corporation, Florida Power Corporation Ten-Year Site Plan Detail as of December 31, 1983, St. Petersburg, FL., March, 1983.

Florida Power & Light Company, Ten Year Power Plant Site Plan, 1984-1993, Miami, FL., April, 1984.

Florida Public Service Commission, Statistics of the Florida Electric Utility Industry, 1982, Tallahassee, FL., 1983.

Gordon, Richard L. Coal and the U.S. Energy Market, Lexington Books, D.C. Heath and Company, Lexington, MA., 1978.

Governor's Energy Office, Florida Energy Data, 1970-1982, Executive Office of the Governor, State of Florida, Tallahassee, FL., December 1983.

Gray, John E., Energy Policy: Industry Perspectives, Ballinger Publishing Co., Cambridge, MA., 1975.

Hillsborough County City-County Planning Commission, Hillsborough County Horizon 2000 Plan, Tampa, FL., 1982.

Kirsten, D., "Railroads vs. Pipelines - Cashing in on Coal, "National Journal, vol 11: 1112-6, July 1979.

Lochner, H.W., Inc. Florida State Rail Plan, Florida Department of Transportation, Tallahassee, FL., March 1978.

Lovins, Amory B., World Energy Strategies: Facts, Issues and Options, Friends of the Earth, Inc., New York, N.Y., 1975.

Manatee County Planning Department, Manatee County Comprehensive Plan, Bradenton, FL., 1980.

Manatee County Port Authority, Tonnage Reports (Various Years), Bradenton, FL.

Maritime Transportation Research Board, Critical Issues in Coal Transportation Systems: Proceedings of Symposium, Nation Research Council, National Academy of Sciences, Washington, D.C., 1980.

Merrill, O. H., T.C. Schweizer, et al., The Florida Statewide Coal Conversion Study: Alternatives to Coal Conversion for Florida Utilities, Science Applications, Inc., McLean, VA., October 1983.

National Academy of Sciences, Energy in Transition 1985-2010 Final Report of the Committee on Nuclear and Alternative Energy Systems, National Research Council, W.H. Freeman and Company, San Francisco, CA., 1980.

NUS Corporation, et al, Coastal Energy Impact Program, Big Bend Study, Final Report, Tampa Port Authority, Tampa, FL., March 1984.

Organization for Economic Cooperation and Development, Coal and Environmetal Protection: Costs and Costing Methods, Paris, France, 1983.

Pasco County Planning Department, Pasco County Comprehensive Plan, New Port Richey, FL., 1982.

Pinellas Planning Council, Pinellas County General Plan, Clearwater, FL., 1979

Post, Buckley, Schuh & Jernigan, Inc., Port Manatee, Master Development Plan Update, Manatee County Port Authority, Bradenton, FL., November 1981.

St. Petersburg Planning Department, St. Petersburg Comprehensive Plan, St. Petersburg, FL., 1976.

Tampa Bay Regional Planning Council, Coastal Energy Facilities Siting Study, St. Petersburg, FL., December 1982.

Tampa Electric Company, Application for Permit to Construct Unit #3 Big Bend Station, Volumes I & II, Tampa, FL., December 1972.

Tampa Electric Company, Ten-Year Site Plan for Electrical Generating Facilities and Associated Transmission Lines, January 1984 to December 1993., Tampa, FL., April 1984.

Tampa Port Authority, Cargo Report (Various Months), Tampa, FL.,

Tobin, R. L., J. D. Jastrow, et al., The Florida Statewide Coal Conversion Study: Coal Supply and Transportation Analysis, Argonne National Laboratory, Chicago, IL., September 1983.

Tomassoni, Mark E., "Transportation of Coal to Seaports via Mid-America Inland Waterway System, "Transportation Research Record Nr. 824, Transportation Research Board, Washington, D.C., 1981.

Transportation Reseach Board, Transportation of Coal, Grain, and Passengers by Rail and Waterways, (TRR #824) National Academy of Sciences, Washington, D.C., 1981.

U.S. Energy Information Administration, Coal Supply and Transportation Model, DOE/EIA-0401, U.S. Department of Energy, Washington, D.C., August 1983.

U.S. Energy Information Administration, Delays and Cancellations of Coal-Fired Generating Capacity, U.S. Department of Energy, Washington, D.C., July 1983.

U.S. Environmental Protection Agency, Environmental Impact Statement, Final: Tampa Electric Company, Big Bend Unit 4 (EPA 904/9-81-084), Atlanta, GA., January 1982.

Vitale, James E. and Frank A. McEvoy, "Impacts of Proposed Transhipment Facility on Price of Delivered Coal in New York, Transportation Reseach Record Nr. 824, Transportation Reseach Board, Washington, D.C., 1981.

Wilbur Smith and Associates, Inc., West Central Flroida Regional Rail Study, Florida Department of Transportation, Tallahassee, FL., June 1980.

Zandi, I. and W. B. Allen, et al, Transport of Solid Commodities Via Freight Pipeline, Vol I-V, Report Nr. DOT-TST-76T-35, U.S. Department of Transportation, Washington, D.C., July 1976.

TAMPA BAY REGIONAL PLANNING COUNCIL STAFF

William A. Ockunzzi	Executive Director
Manuel L. Pumariega	Administration & Finance
Michael R. McKinley	Planning Director
Margaret E. Gross	Administrative Services
Mary G. Wiser	Community Affairs
Julia E. Greene	Social Services
George G. Cardwell	Principal Planner
Bruce Gaul	Graphic Artist
Lesley S. Kelly	Secretary
Mark Swearingen	Press Operator